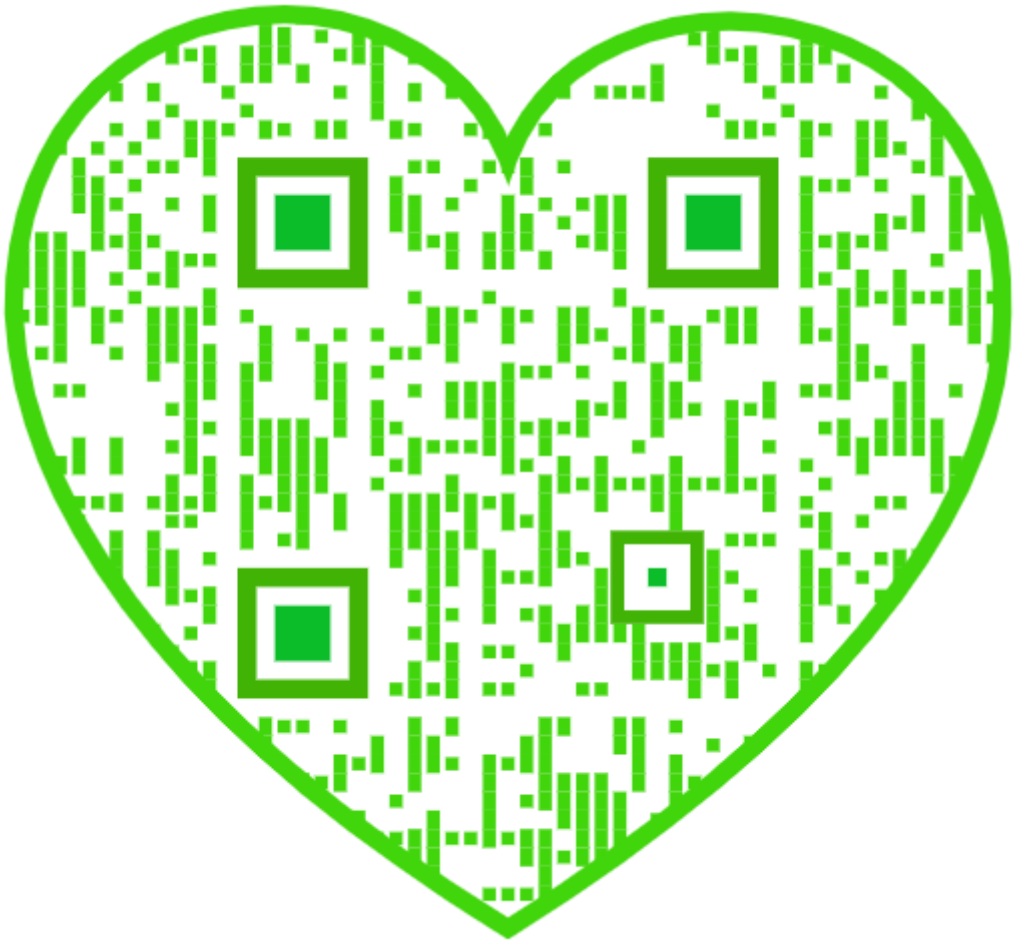

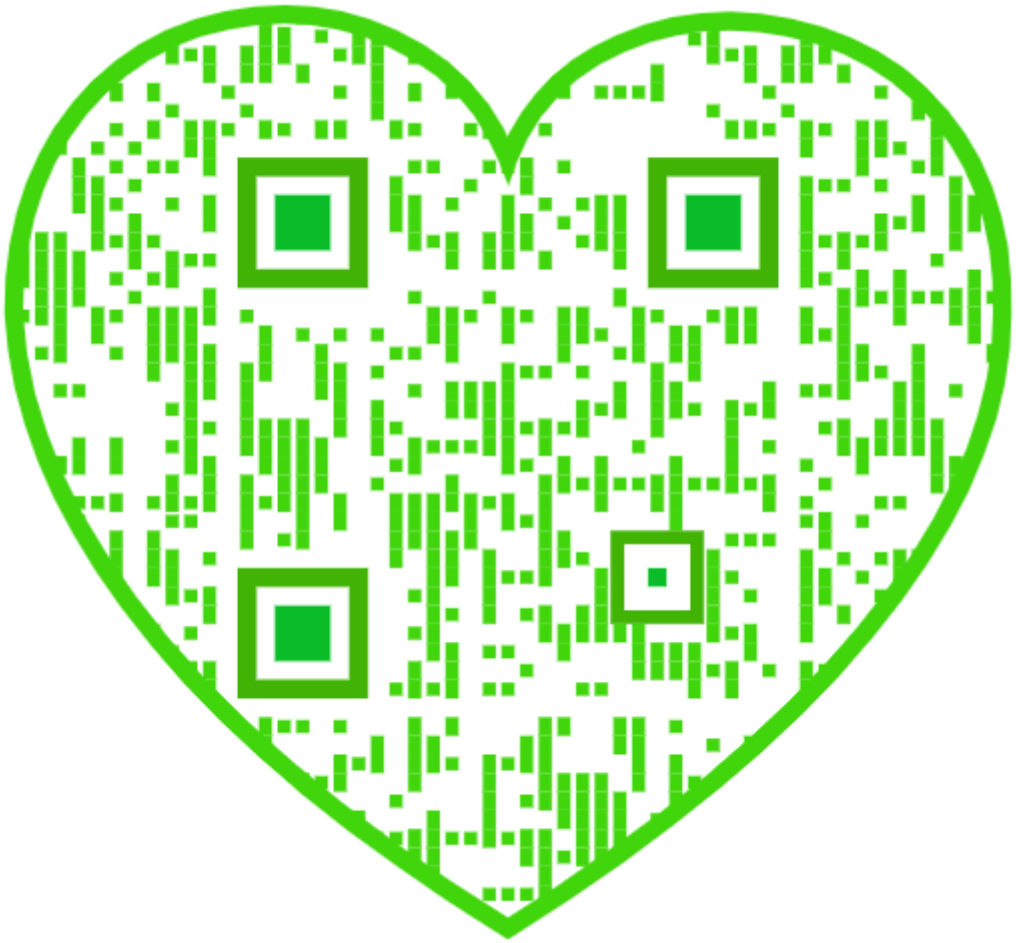

MEDICAL WAR MANUAL No. 1

Authorized by the Secretary of War
and under the Supervision of the Surgeon-General
and the Council of National Defense

Sanitation for Medical Officers

BY

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PREFACE.

THIS work was created to supply in a compact form that can be conveniently carried in the pocket of a uniform, such data as may be useful to medical officers as a guide for sanitary work. As far as possible the information has been made official by the inclusion of the sanitary orders and circulars bearing on the topics discussed. All notes have been made as brief and concise as possible. An endeavor has been made in writing the section on transmissible diseases to present the most recent knowledge concerning the etiology and transmission of the disease in question, together with all information necessary upon which to base a sanitary campaign for its control.

It is needless to state that no originality is claimed for the material presented, which is in the nature of a compilation derived from many sources. Special acknowledgment should be made to Havard's *Military Hygiene*, Melville's *Military Hygiene and Sanitation*, and Lelean's *Sanitation in War* as works from which I have borrowed largely.

E. B. V.

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THE CAMP.[1]

THE RECRUIT.

THE most important factor in securing the physical efficiency of the soldier is the proper selection of the recruit. The subject is dealt with in all works on military hygiene, and specific instructions for the physical examination and selection of recruits will be issued by the War Department from time to time. At present these orders are changing so rapidly that it is not advisable to include them in this book.

MEASURES TO CORRECT DEFECTS.—In times of peace an effort is made to accept only men without physical defects. In time of war many men will necessarily be accepted as fit for service but who have minor defects that can be corrected. But some system should be employed, otherwise these defects will not be corrected, and the man will subsequently become a burden to the command while on active service. If the following form is filled out at the time the physical examination is made, the camp surgeon could keep a file of these cards and defects could be corrected systematically during the period of training. Thus a list of the men needing dental treatment could be made out and these men ordered to report to the dentist.

[1] See F. S. R., 1914, 232–245.

1. Conformation: Weight, Height, Pignet's index.
2. Skin: Normal? Diseased?
3. Muscles: Well developed? Moderately developed? Flabby?
4. Bones and Joints: Normal? Diseased?
5. Teeth: In good repair? Repairs necessary? Urgent repairs?
6. Feet: Corns? Hallux valgus? Weak arches? Other defects?
7. Circulation: Pulse? Blood-pressure? Any defects?
8. Respiratory system: Any defects?
9. Genito-urinary: History of infection? Wassermann? Urine? Defects?
10. Gastro-intestinal: Constipation? Other defects?
11. Nervous system:
12. Eye, ear, nose and throat: Defects.
13. Other diseases or defects?
14. Cleanliness?
15. Habits: Tobacco alcohol sexual dietary sleep
16. Endurance?
17. Fit for field service?
18. Corrective measures?

Until some such plan is adopted it would be advisable for the camp surgeon to direct that a physical examination be made and the form filled out in the case of all men who present themselves on sick report for any cause, and that the corrective measures indicated as necessary should be systematically applied.

MALINGERING.—While in time of peace malingering is very rare, medical officers may expect to meet with a certain percentage of malingerers among those who wish to escape military service in time of war. Sometimes it will be necessary to determine whether a man is a malingerer or is suffering from hysteria or neurasthenia. Hysteric and neurasthenic men are best excluded from military service, but effort must be made to detect malingerers. This is usually easy when a patient can be observed over a considerable period, but may be very difficult at a single examination. Malingering is detected in several ways.

1. Few people know the symptoms or signs of any infirmity well enough to feign it successfully, and if the examining

physician is thoroughly posted on the symptomatology of the condition being simulated, he can usually detect discrepancies.

2. The use of methods to put the patient off his guard and to watch him when he believes he is alone.

3. *The Psychology of the Malingerer.*—He is apt to be unduly voluble in presenting his symptoms, or may be unduly reticent, and his language and actions are often inconsistent.

4. *Suggestion.*—If it is suggested that a certain symptom is usually present in the condition complained of, a malingerer will frequently produce the symptom even though it may be ridiculous.

5. *Special Tests.*—It would be impossible to cover the subject of malingering within the limits of these notes, but a few simple tests for the disabilities commonly feigned may be useful to medical officers.

Cardiac and circulatory lesions may be feigned by taking various drugs just before the examination. Tobacco has been swallowed. In the British service, cordite has been chewed. When anything of this kind is suspected, the man should be placed in hospital under observation and examined unexpectedly.

Urine.—Sugar and albumin have been placed in samples of urine. Sometimes cane-sugar is used, which is never found in urine. If glucose is used, too much is commonly added, and the amount varies considerably at different times. Make the patient urinate in the presence of the examiner.

Epilepsy.—Epilepsy is often claimed to exist. If malingering is suspected, as it may be if too many claiming epilepsy present themselves, the man may be accepted and placed under observation. The malingerer seldom attempts a fit in the presence of a medical officer. Soap may be chewed to produce a foam. The true epileptic is always unconscious in a fit. This may be tested by touching an

eye to determine the presence of the conjunctival reflex, or by pressure over the supra-orbital notch.

Bed-wetting.—This is a bar to enlistment for obvious reasons. Yet frequently men who wish to avoid military service will claim to be bed-wetters and will persistently live up to the claim. The percentage of adult bed-wetters is almost infinitesimal, and malingering is to be suspected should two or more cases occur at about the same time. The remedy is to place a night man on duty to wake the suspect every hour to make him urinate. If a malingerer he will usually give up after several such nights.

The Eye.—Every man knows that eyesight is essential in the military service and that visual defects may relieve him of irksome duty. It is imperative to distinguish between actuality and pretence. The most common form of malingering is a statement that one eye is imperfect, and the man pleading this disability may either pretend to have the defect, or may actually have a defect and trade upon it. Each such case must be regarded as genuine until proved otherwise. Take the vision for distance, and with the ophthalmoscope the state of cornea, iris, lens and vitreous should be noted. The malingerer may resist this examination by winking or other means. The retina is examined and the refractive index estimated. When a defect is claimed that cannot be accounted for objectively, it is to be suspected. Take the trial frame and place a blank opposite the good eye and a plus 3 or 4 before the eye to be tested. Then add minus glasses until the frame for the eye to be tested contains minus glasses enough to exactly neutralize the previous plus glass. In a majority of cases this will be successful, for if any improvement is admitted, the man is a malingerer. The man may read the letters with his lips while claiming not to see them. Be on guard against pupils artificially dilated with atropine or cocain.

Complete blindness is seldom alleged, but alleged blindness

of one eye is common. The pupil of a blind eye cannot be made to contract to the smallest degree by even a strong light. Be sure mydriatics have not been used. The pupil of a blind eye is generally dilated and a blind eye generally deviates when the sound eye is fixed. Take the trial frame. Opposite the good eye place a plus 12 lens. This puts it out of action. A plain glass is then put in front of the alleged blind eye, and print of a large size is suddenly placed before him. If he reads test types of any size, the deception is proved. A prism base downward may be placed before the good eye while the man looks at a distant candle. If he sees two candles, binocular vision is proved.

Color-blindness is not a bar to enlistment for the line.

Tests for Hearing.—Absolute deafness is seldom feigned, but deafness of one ear is often claimed. Pretended deafness is not always easy to detect. A man who is deaf and wishes to hear involuntarily turns his head to the speaker. If the patient does not do this, or only at times, he should be suspected. Examine the meatus by reflected light, meanwhile assuming the deafness for granted. If wax is present, remove it. See if the tympanum is normal.

There are two kinds of deafness: (1) When the sound-conducting apparatus (tympanum and ossicles) are damaged. (2) Nerve-deafness, the result of derangement of the internal ear. Normally when a tuning-fork is made to vibrate and held opposite the outer canal, it is heard for a longer period than if the base is applied to the bone behind the ear. If the sound-conducting apparatus is damaged, the tuning-fork when placed against the skull will be heard for a longer time than when it is placed opposite the external ear. Should the tympanum and ossicles be wholly destroyed, the tuning-fork will not be heard at the external ear, but will still be heard when placed on the skull, for sound still reaches the nerve through the bones of the skull. In nerve-deafness if a tuning-

fork is applied to the bone behind the ear, the vibrations are not heard as long as when it is applied outside the meatus.

Tests.—If when the sound ear is apparently closed with the hand, but leaving a chink between the fingers, and the patient states that he hears nothing, there is sufficient evidence of malingering. Assuming that the deafness is alleged in the left ear, a tuning-fork is placed behind the left ear and the right ear closed. Even though the left ear is completely deaf, the vibrations will be conducted by bone to the sound ear and be heard, but a malingerer will often deny all knowledge of the sound. The patient may be blindfolded, and a watch held at varying distances and the results recorded. If malingering is attempted, it is impossible for accuracy to be maintained, and the results often vary so that detection is easy. Thus the patient may state that he does not hear it at one foot when he says he does hear it at three feet.

Pain in the Back.—This is frequently alleged as a cause of disability. When pain exists in the spine, stiffness and rigidity naturally follow. If there is no stiffness and no rigidity, it is reasonable to suppose that there is no actual disease of the spine.

Lumbago.—Lumbago is bilateral, widespread, relieved by pressure and mostly experienced when making certain movements.

Injury.—The usual injury is a tearing of the fibers of some of the lumbosacral muscles. It is almost invariably unilateral.

When a man is suspected, blindfold him and ask him to point out the painful spot. Mark it with a blue pencil and after further examination repeat. If the pain is assumed he may point to a spot several inches from the first one. When his attention is diverted to the sound side, considerable pressure may be applied to the affected side without eliciting evidence of pain. If a man has pain in the upper part of the back, this can generally be elicited by bending the head for-

ward while the trunk is held rigid, thus stretching the vertebral muscles. If this can be done without pain, it is probable the alleged pain does not exist. If the patient claims he cannot bend his back, let him suppose he is not watched and notice how he puts on his shoes.

The Nervous System.—When disease of the nervous system is claimed, a comprehensive examination will usually establish the truth or falsity of the claim.

Pupil Reflex.—Eliminate disease of the eye and the effect of drugs that may be taken for the purpose of deception and test eye for:

1. Loss of light reflex alone, *i. e.*, the Argyll-Robertson pupil; this is usually found in tabes dorsalis and paresis.
2. Loss of contraction of pupil during accommodation and also of light reflex; usually in tabes dorsalis.
3. Loss of all pupil reflexes; commonly due to syphilis.
4. Inequality of pupils. Tabes, paresis, aortic aneurysm and other conditions.

Knee-jerk.—This may be simulated or exaggerated. Make patient close both eyes and distract attention before making the test.

Babinski Reflex.—Extension instead of flexion of great toe when sole is tickled. If persistent in an adult it indicates an organic lesion.

Ankle-clonus.—True ankle-clonus is difficult to feign and should be accompanied by the Babinski reflex. Test for instability. Romberg's sign.

Pain.—When feigning pain, malingerers may shrink before being touched, and complain bitterly before they can have been hurt. Blindfold and make patient locate pain with the finger; often he cannot touch the same spot twice. Is there an interval between the movement alleged to be painful and the expression of pain? The two are instantaneous if pain is real. Objective symptoms of pain are flushing or pallor of face, dilatation of pupil and increased rapidity of the pulse.

Areas of Anesthesia.—Bandage the eyes and map out with a pin and colored pencil the alleged anesthetic area, and repeat the procedure several times, when if a malingerer, the area will be found to vary.

VACCINATION AGAINST SMALLPOX AND TYPHOID FEVER.—After a recruit has been accepted the next duty of the medical officer will be to vaccinate him in accordance with existing orders which follow. Here again it will be found that system is indispensable in vaccinating large numbers of men. The men should be lined up by companies with the left arm bared. A number of men should assist in the operation. One man washes the arm, another paints it with tincture of iodine and the recruit then passes to the surgeon who gives him his injection. He then passes to another surgeon who vaccinates him against smallpox, and then passes to a clerk who makes out his record. The surgeon who gives the typhoid should have a small instrument boiler with a number of hypodermic needles, and as soon as one injection is given, the needle is dropped into the boiler and a clean needle that has been boiled is selected for the next man. By using some such system, a very large number of men can be vaccinated against both typhoid and smallpox in one day.

G. O. No. 30, W. D., Washington, April 21, 1914. Vaccination being recognized as an effective means of preventing smallpox, all recruits upon enlistment and all soldiers upon reënlistment will be vaccinated. When the first vaccination of a recruit is non-effective, it will be repeated at the end of eight (8) days.

All the personnel of a military command, station, or transport, including civilians connected therewith, will be vaccinated when in the opinion of the surgeon responsible for proper sanitation it is necessary as a means of protection against smallpox. Civilians refusing to be vaccinated when so directed by proper authority may be excluded from the military reservation or station.

Officers should be vaccinated at least once in a period of seven years. Troops under orders to perform oversea journeys or field service will be inspected by a surgeon with respect to their protection against smallpox, and those who in the opinion of the surgeon require it will be vaccinated.

Bulletin No. 30, W. D., Washington, July 15, 1914. In carrying out the requirements of Paragraph II, General Orders, No. 30, War Department, 1914, all vaccinations will be preceded by cleansing of the site, preferably the brachial insertion of the deltoid, with water and alcohol.

The skin at selected site must be clean; antiseptics are not necessarily employed; should they be used they must be washed away with sterile water that the activity of the virus be not destroyed. Washing with warm water, followed by alcohol, is usually sufficient, the alcohol being permitted to evaporate before proceeding. Scrubbing with soap and water is necessary for a dirty skin, but needless irritation of the skin is to be avoided.

The procedure described as follows is preferable to "scarification," which will no longer be used:

Incision is the method of choice and it should be made with the point of a sterile needle, producing a "scratch." A sterile scalpel may be used, but is more likely to cause bleeding. The incision or scratch should preferably not draw blood. There should be at least two incisions, three-quarters of an inch long and one inch apart; after exposure to smallpox four incisions will be made. The virus is then placed upon the abraded surface and gently rubbed in, unnecessary irritation being avoided.

The wound is allowed to dry thoroughly and can be left without dressing, though several layers of gauze may be applied with adhesive plaster. Any dressing that retains heat and moisture is bad. Shields will no longer be issued.

Bathing is permitted, but unnecessary use of the limb is to be discouraged when practicable.

G. O. No. 4, W. D., Washington, January 20, 1915. Paragraph II, G. O. No. 76, W. D., 1911, as amended by G. O. No. 134, W. D., 1911, is rescinded and the following substituted therefor:

All persons entering the military service will be immunized against typhoid fever, under the direction of a medical officer, as soon as practicable after entrance. Exception may be made in the case of persons over 45 years of age, and when the occurrence of a previous attack of typhoid fever or a complete course of immunization within three years is established to the satisfaction of the responsible medical officer.

Cadets at West Point will be immunized on entering the Academy.

Officers under 45 years of age will be reimmunized after five years, and enlisted men on the first reënlistment following the original administration. Except when directed by the War Department, only two complete courses of immunization will be required during service in the Army.

Reimmunization will consist of a series of three injections given exactly as in the first series.

Recruits will be immunized at places of enlistment, unless, because of special assignment or other reason, the men are not to remain at the station long enough to allow the completion of the course, in which event the immunization will be completed immediately after they join the organizations or stations to which they are assigned. On the descriptive and assignment card of every recruit or reënlisted man will be noted "Typhoid and paratyphoid immunization completed. . . . (Date). . . . " or "Typhoid immunization not administered," as the case may be. In the latter case company and detachment commanders will see that the immunization is begun immediately after the men join the organizations or stations to which assigned. In every case in which immunization has been completed, the remark, "Typhoid

immunization completed.... (Date).....," will be entered on the soldier's descriptive list.

Civilian employees who are subject to field service of any kind, including those on transports and in the mine planter service, will be immunized as soon as employed. Officers under whom such employees are working will enforce this order.

The typhoid prophylactic to be used is manufactured exclusively at the Army Medical School, Washington, D. C., and detailed directions for its use are given in circulars from the Surgeon General's Office.

Records will be kept at the hospital of all officers, soldiers, and civilians in the military service who receive the anti-typhoid prophylactic, giving the dates of immunization.

Circular No. 16, W. D., Office of the Surgeon-General, Washington, March 20, 1916. I. The following directions for vaccination against typhoid fever and for keeping the necessary records are published for the information of medical officers.

The first dose is ½ c.c. (7½ m.); the second and third are each 1 c.c. (15 m.). An interval of at least seven days should elapse between doses. This interval may be extended to the fourteenth day in case of necessity.

The site of the inoculation is the arm at the insertion of the deltoid muscle. If for any reason this site cannot be used, the needle may be introduced in the back, over the lower portion of the scapula, or in the chest below the clavicle. The dose is to be given *subcutaneously* and not in the muscles nor into the skin. The arm should be cleansed as for any other operation. Tincture of iodine painted over the dry skin, before and after the injection, has proved satisfactory.

The ampule should be washed off in an antiseptic solution and opened after making one or more cuts near the top with a file. The vaccine can be drawn out of the container with a

syringe, or it may be emptied into a shallow glass dish, such as a salt cellar, which has been sterilized by boiling.

The syringe and needle should be sterilized by boiling in 2 per cent. soda solution. To insure perfect sterilization, draw the piston out to its full length, or remove it entirely, so that the barrel is full of water during the boiling. A fresh needle should be used for each man, or, if one needle must be used on two or more men, it should be resterilized before each injection.

No person should be vaccinated who is not perfectly healthy and *free from fever*. The temperature will be taken before vaccination is begun, and in doubtful cases the urine should be examined; if fever or any other symptoms of illness are present, the procedure should be postponed. This precaution is necessary to avoid vaccinating men who may be in the incubation stage of typhoid or other fever. Neither beer nor alcohol in any other form should be drunk on the day of treatment. Vaccination is well borne by children and by women, using doses proportionate to the body weight, taking 150 pounds as the unit. Women should not be given the first dose during or near the time of the menstrual period.

The most suitable time for the administration is about 4 o'clock in the afternoon, as the greater part of the reaction is then over before morning. There is usually some headache and malaise, and a local reaction consisting of a red and tender area about the size of the palm of the hand, and sometimes tenderness in the axillary glands. It is best not to require any duty for twenty-four hours, not to permit active exercise, such as long rides or walks. Rarely marked general reactions occur—headache, backache, nausea, vomiting, herpes labialis, occasionally albuminuria, and some loss of body weight. The number of such reactions is exceedingly small, and, regardless of their severity, they, as a rule, disappear inside of forty-eight hours.

The Widal reaction is positive after typhoid vaccination, appearing in about ten days after the first dose, and it remains

positive for six months to a year. This fact must be considered in diagnosing typhoid in vaccinated persons. They may give a positive Widal regardless of the nature of the illness, and the reaction is consequently of no assistance in diagnosis.

If typhoid or paratyphoid fever be suspected, the diagnosis must therefore be confirmed by blood culture, made during the *first week* of the disease; this culture will be sent to the Army Medical School or to one of the department laboratories. Bottles of bile medium for this purpose may be obtained of the Army Medical School, Washington, D. C.; the department laboratory, Fort Leavenworth, Kan.; the commanding officer, Letterman General Hospital, Presidio of San Francisco, Cal.; the department laboratory, Southern Department, San Antonio, Tex.; the department laboratory, Hawaiian Department, Honolulu, H. T.; or the laboratory, Ancon Hospital, C. Z. Two bottles of bile medium will be kept on hand at all hospitals. A subculture from any positive blood culture will be sent to the laboratory, Army Medical School, for confirmation and record.

A complete record will be kept on a Vaccination Register (Form 81) for each person vaccinated, showing the name, organization, date of each dose of vaccine given, and a record of the temperature taken immediately before giving the first dose of vaccine. On completion of the vaccination, a statement to that effect, giving the date, name, rank, and organization, will be sent to the commanding officer of the organization to which the man belongs, that the proper notation may be made on the descriptive and assignment card of every recruit.

In every case of typhoid or paratyphoid fever, or suspected case of these diseases, occurring in an officer or enlisted man, a statement will be made on the register card (Form 52), showing the number of doses of vaccine given and the date of the last one. If the patient has not been vaccinated against

typhoid fever a notation to that effect, stating the reason or other circumstances learned, will be entered on the register card. A report will be furnished in every case of typhoid and paratyphoid fever occurring in an officer or enlisted man or a civilian employee who has been vaccinated, describing in detail the method of arriving at the diagnosis *as soon as it is made.* This report will follow the form required by this office.

The vaccine should be stored in an ice-box. It will keep for four months and perhaps longer when stored at low temperatures in the dark.

A fresh ampule should be opened for each day's use. Any vaccine remaining unused in an opened ampule at the end of the day should be thrown away. The only typhoid vaccine used will be that obtained from the Army Medical School, and will be furnished on request by information slip or by telegram to the commandant. When for any reason a larger stock is on hand than appears to be needed, directions as to its disposition will be obtained from the commandant, Army Medical School, upon application to him direct, stating date of receipt of the vaccine. Stock over four months old will be destroyed when a new supply has been received.

II. Circular No. 15, W. D., Surgeon General's Office, December 29, 1914, is hereby superseded.

G. O. 68, June 1, 1917, W. D. I.—In addition to vaccination against typhoid fever prescribed in Circular 16, W. D., Office of Surgeon General, 1916, all officers and enlisted men of the U. S. Army and all other persons associated with the military forces of the United States designated for service overseas, will be completely vaccinated against paratyphoid fevers ("A" and "B") prior to their arrival in Europe.

Vaccination against paratyphoid fever will be given in same manner, in same dosage, and with same intervals as now prescribed in Sec. I, G. O. 4, W. D., 1915, as amended by Sec. IV, G. O., 23, W. D., 1915 (par. 273, C. of O., 1881–1915), for vaccination against typhoid fever. The only

vaccine used for this purpose will be the mixed "A" and "B" vaccine, prepared in laboratories of the Army Medical School, Washington, which can be had upon direct application to commandant of the school.

This order will be strictly enforced.

THE SANITARY SURVEY OF CAMP SITES.

THE senior medical officer on duty with any detachment in the field will make a sanitary survey of the area covered. When practicable, this survey will be made prior to occupancy of the ground by the detachment. The survey should cover the following points:

CAMP SITE.—1. Locate on map those actually occupied, and such other areas as offer special facilities.

2. Study and describe these sites with reference to terrain, area, soil, drainage, proximity to roads, water supply, shelter, possible methods for disposal of wastes, etc.

3. Under war conditions, consider the shelter afforded by the terrain for first-aid stations and field hospitals, as well as availability of water, fuel, shelter, etc.

4. Consider the facilities and means for evacuation of sick and wounded, including nearness to railroad, and condition of roads. If several routes are available, determine which is most suitable.

WATER SUPPLY.—1. Locate on map and note the source, distance from camp, potability and quantity available.

2. If a stream, consider the possibility of contamination above intake. This is always possible if it flows through an inhabited district.

3. Steps recommended to ensure its continued purity, including precautions to be taken to prevent its fouling by the command in case other troops are encamped below the intake.

4. If the water is not considered safe, outline the means to be taken to make it safe.

FOOD SUPPLY.—1. What food and forage can be obtained from the inhabitants of the surrounding country?

2. Make all necessary recommendations as to the conservation and preparation of this food supply from a sanitary stand-point.

HEALTH CONDITIONS OF SURROUNDING POPULATION.—1. Investigate the sanitary condition of all places through which troops pass or in which they halt. Investigate particularly the presence of infectious disease among the inhabitants.

2. If disease be present and a halt must be made, outline the precautions that must be taken to avoid infection of troops.

INSECTS.—1. Investigate carefully for the existence and prevalence of flies and mosquitoes. What disposition do the inhabitants make of their manure. If there is any accumulation of manure, it may be assumed that there will be many flies in warm weather.

2. Outline measures to be taken to abate these nuisances: (1) By the command. (2) By the inhabitants.

WEATHER CONDITIONS.—1. Investigate the daily and seasonal variation in temperature, the usual amount of rainfall, prevailing winds and other weather conditions that may affect the health of the command, and make appropriate recommendations.

SANITARY ORDERS.

Medical officers should be prepared to write a comprehensive but clear and concise sanitary order should they be called upon to do so. Such an order should first outline the sanitary duties and responsibilities of the various members of the command, including the Chief Surgeon, Sanitary Inspectors, and Regimental Surgeons. The order should then proceed to give explicit directions with regard to the sanitation of the camp. As conditions vary, no set of directions will be suitable for all times and places, but such an order

should include directions with regard to the Water, Disposal of Excreta and Kitchen Wastes, Disposal of Manure, and instructions for Venereal Prophylaxis, with such other subjects as the time and place may call for. The following is suggested as a model upon which such orders may be drawn.

G. O. No. — HEADQUARTERS MANEUVER DIVISION,
Plattsburg, N. Y.,
April 6, 1910.

The following regulations for camp sanitation are published for the information and guidance of all concerned:

1. *Responsibility for Sanitation.*—Commanders of all grades are responsible for police and sanitation and for the enforcement of the provisions of these regulations within their organizations.

2. *Division Surgeon.*—The division surgeon is charged, under the commanding general, with the general conduct and supervision of the Medical Department of the division in the performance of its duties and will make recommendation concerning all matters pertaining to the sanitary welfare of the command.

3. *Sanitary Inspector.*—The sanitary inspector is assistant to the division surgeon and is charged especially with the supervision of the sanitation of the command to which he is assigned. It is the duty of organization commanders to remedy defects reported to them with the least possible delay.

4. *Sanitary Squads.*—Sanitary squads will be organized by the division surgeon for special sanitary purposes such as the purification of water supplies, mosquito and fly prevention, disposal of wastes, and disinfection. They will consist of officers, non-commissioned officers and privates, first class or privates of the Medical Department, assisted by civilian

sanitary laborers employed by the Quartermaster Corps, and when necessary, by details of officers and enlisted men from other branches of the service.

5. *Regimental Surgeons.*—The senior medical officer on duty with a regiment or separate unit will inspect his camps once daily and oftener if necessary, at which time the several organization commanders will be present during the inspection of their respective commands if practicable. All sanitary defects with proper recommendations to remedy the same will be reported to them, and they will immediately take the necessary steps to correct the defects, if within their authority. If such is not feasible, or is impracticable, they will immediately forward a report on the same, for the action of the higher authority.

6. *General Police.*—At all inspections special attention will be given to the condition of the grounds, tents, kitchens, food, bathing facilities, and latrines. The interior of the tents must be kept clean, and the clothing, blankets and bedding should be exposed to the sunlight daily, weather permitting. Tents will be raised during the daytime in good weather, and will be adequately ventilated at night. All tents will be furled and struck occasionally.

7. *Kitchens.*—All food and water in camp will be protected from dust, flies and sun. An eating place will be designated for each company, and men will not be allowed to take food into their tents. Eating utensils will be thoroughly cleaned immediately after using. Garbage will not be allowed to accumulate about the kitchen, but will be promptly destroyed in kitchen crematories. In all cases all kitchen refuse should be thrown on the incinerator at once in order to avoid attracting flies. Do not throw any water from the kitchen including that used for washing cooking or eating utensils on the ground. This is strictly prohibited. The use of garbage cans will not be permitted; they attract flies. Water barrels or cans for drinking water will be kept securely covered and set upon

a framework so that the faucets will be 3 feet from the ground. Water will be taken from the barrels or cans in no other way than by drawing it from the faucets.

8. *Water Supply.*—The camp water supply is pure and wholesome, and no sterilization of drinking water is necessary (should this not be the case the statement should read: "The water supply is impure and must be sterilized before use. Minute directions for sterilization should then be given). Precautions must be taken to prevent subsequent contamination, by keeping all containers scrupulously clean and protected from dust and other sources of infection. (In some cases it may be necessary to place a guard over the water supply, and in these cases the sanitary order must be formed to suit conditions.)

9. *Disposal of Excreta and Wastes.*—Organization commanders will be held responsible for the police of their respective camps. Each company or similar organization will construct incinerators or crematories as prescribed in Sec. 216, F. S. R., 1913, for the disposal of all solid and liquid garbage of the organization, and no other disposition will be made of such wastes. Human excreta will be disposed of in pits covered by latrine boxes unless other provision has been made. Two urinal cans will be placed in each company street at night. Latrine pits will be burned out, and seats scrubbed daily, using crude oil and straw or other material. Urinal cans will be burnt out daily, and the bottoms covered with milk of lime before using. Defilement of ground in and about camps is absolutely prohibited. Manure will be hauled to a designated dumping ground, and there burned with the aid of crude oil. Rock pit crematories will be used for the disposal of general wastes of camp areas not under the jurisdiction of commanding officers.

10. *Latrines.*—Will be constructed at the rate of one for each company, one for the officers of each regiment, and one for Brigade Headquarters. The pit shall be 3 feet wide,

8 feet long, and 8 feet deep, and the excavated dirt shall be removed at least 4 feet from the pit. The latrine box must be fly-proof, 4 feet wide, 9 feet long, and 18 inches high, with sides sloping outward to prevent soiling. The top will have suitable holes at intervals of 2 feet from center, each to be provided with a cover strongly hinged. Through the center of the cover will be placed 6-inch strips and stop blocks to prevent the covers from being raised so far that they will not fall back into position of their own weight. (For construction of latrine box see blue print furnished by Quartermaster Corps, one of which will be on file at office of Camp Quartermaster.) Toilet paper will be furnished and must be kept from blowing about or lying on the ground. A lantern will be kept burning in each latrine during the hours of darkness.

11. *Picket Lines.*—Picket lines and places where horses are tied shall be kept thoroughly cleaned. In addition to careful raking of manure, the ground at each picket line will be swept with suitable brooms at least three times a day, and the manure piled. The manure shall be removed at least once a day. All picket lines will be burnt off by the use of hay and crude oil at least once every ten days.

12. *Food and Drinks.*—No food, drinks, or like commodities will be sold in camp except in the authorized exchanges.

13. *Personal Cleanliness.*—Each soldier must bathe at least twice weekly. Men must wash their hands thoroughly after leaving the latrine, and before each meal. Bath houses must be kept clean and inviting, and the water drained properly both inside and outside.

14. *Venereal Inspections.*—Venereal inspections will be held once each week, at which time all enlisted men of the command must be inspected. At these inspections a careful record will be made of all cases of venereal disease discovered, and a report of the same be furnished to the man's immediate commanding officer.

15. *Venereal Prophylaxis.*—Each organization will provide a tent or other place in which the venereal prophylaxis may be administered, and will keep a record of the men to whom it is administered, with the time of application and such other information as may be necessary. All men are directed to apply for this treatment at the earliest possible time after exposure, should such exposure unfortunately occur. All men are hereby cautioned against exposing themselves.

By Command of Major-General Jones,

JOHN SMITH,
Adjutant-General and Chief of Staff.

SANITARY INSPECTION FORM.—A form similar to this may be used as a report. When so used, should any defect be found it is sent at once to the regimental adjutant who later sends it by orderly to each organization commander concerned. These may initial in the proper space to show that they have seen it and will correct defects. The adjutant then sends form to the chief surgeon. This particular form is purely optional. Experience has shown that unless some such form be followed in making inspections, even experienced officers will overlook important matters that require attention. There are so many things to invite attention in inspecting an organization, that some such form is a great assistance. Many of the questions in the following are general, and suggest a whole set of further questions. It is suggested that each medical officer who makes sanitary inspections should prepare a Special Sanitary Report based on the following model, but which will embody those questions that are particularly pertinent to the camp in question.

Special Sanitary Report.

Date.....

Camp of (fill in organization)
Hour when inspected.....
Accompanied by regimental or battalion medical officers?.....
Are these officers well informed as to local conditions?.....
Have previous recommendations been carried out?.....
Are the sanitary squads efficient?.....
Is the general police of the camp excellent?.....
Are sanitary inspections frequently made by regimental medical officers?
Is the camp dusty or muddy and can this be remedied?.....
Are the tent walls raised daily, and for how long?.....
Are the tent interiors orderly and clean?.....
Is bedding and clothing sunned daily?.....
Recommendations as to clothing and equipment?.....
Are the kitchens and cooks clean?.....
Is food screened from flies?.....
Is it protected from dust?.....
Is the ice-box clean and sweet?.....
Are flies numerous about the kitchen? Are fly traps used efficiently?....
Is the garbage promptly burned? Does the incinerator function well?..
Is the ground soiled by cooking or wash water?.....
Are the men required to wash the hands before eating?.....
Is food ample, of good quality and well prepared?.....
Are the water cans kept freshly filled and covered?.....
Is the ground near the water taps kept dry?.....
Is there any reason to suspect water contamination?.....
Are flies numerous about the latrines?.....
Are they fly-tight?.....Properly burned out daily?.....
Is toilet paper provided?.....Are latrines lighted at night?.....
Are any other errors noted about the latrines?.....
Where may the men wash after leaving the latrine?.....
Are urine cans used nightly and properly cleansed?.....
Is there an organization lavatory?.....Is it properly drained?.....
Are the picket lines clean?..Is the manure removed and burned daily?..
Is there any evidence of fly breeding about picket lines or kitchen?.....
Is there any evidence that the ground is polluted by excreta?.....
Are there any hucksters in camp, or stands where food or drink is sold?...
Is the milk supply healthful and satisfactory?.....
Are venereal inspections made?.....How often?.....
Is the venereal prophylaxis properly administered? To how many men?
Is the venereal rate of the organization excessively high?.....
Is the general sick-rate unduly high?.....
Is it due to an excess of admissions for any one cause?.....
Is there any evidence of vermin?.....Bed-bugs?.....Lice?.....
If mosquitoes are present, are mosquito bars properly used?.....
Are there any other defects or suggestions?.....

Signature.

DIET.

No elaborate discussion of dietary principles is desirable in a hand-book of this character. But as a sanitary officer may be called upon at any time to express an opinion as to whether a certain diet is sufficient, he should have at hand sufficient data upon which to base this opinion.

Basal Requirements.—The large calorie is the amount of heat necessary to raise one kilo of water at 20° C. through 1° C. It is obvious that the energy expended by a man in maintaining the bodily temperature or in work must be supplied in his food. The amount of heat dissipated by a man at absolute rest has been determined very accurately by observations in calorimeters. In accordance with such observations the minimum basal requirements of a 156-pound man may be stated to be about as follows, for a period of twenty-four hours:

Absolute rest in bed without food	1680 calories.
Absolute rest in bed with food	1840 "

After supplying this minimum requirement of metabolism, an additional supply of energy must be furnished dependent upon the amount of work performed. This may be estimated as follows:

	Calories.
Rest in bed 8 hours, sitting in chair 16 hours	2168
Rest in bed 8 hours, sitting in chair 14 hours, walking 2 hours (professional men, clerks, etc.)	2488
Rest in bed 8 hours, sitting in chair 14 hours, vigorous exercise 2 hours	2982
Estimated expenditure of soldier in barracks	3000
Constant muscular work, painters, carpenters, etc.	3300
Farmers	3500
Stone masons	4500
Lumbermen	5000
Soldiers marching and on active service	4500 to 5000

The energy yield of the food constituents.

	Rubner.	Atwater.
1 gram protein yields	4.1 calories.	4.4 calories.
1 gram carbohydrate yields	4.1 "	4.1 "
1 gram fat yields	9.3 "	9.4 "

TABLE OF FOODS GIVING THE WEIGHT (IN GRAMS, OUNCES AND ROUGH MEASURE) OF A "STANDARD PORTION" OF EACH FOOD AND THE NUMBER OF CALORIES IN THAT "PORTION" IN THE FORM OF PROTEID, FAT AND CARBOHYDRATE.

Name of food.	"Portion" containing 100 calories roughly described.	Weight of 100 calories.		Per cent. of		
		Grams.	Ounces.	Proteid.	Fat.	Carbohydrate.
COOKED MEATS.						
[2] Beef, round, boiled (fat), 1099[3]	Small serving	36.0	1.3	40.0	60.0	
[2] Beef, round, boiled (lean), 1206[3]	Large serving	62.0	2.2	90.0	10.0	
[2] Beef, round, boiled (med.), 1188[3]	Small serving	44.0	1.6	60.0	40.0	
[2] Beef, 5th right rib, roasted, 1538[3]	Half serving	18.5	0.65	12.0	88.0	
[2] Beef, 5th right rib, roasted, 1616[3]	Small serving	32.0	1.2	25.0	75.0	
[2] Beef, 5th right rib, roasted, 1615[3]	Very small serving	25.0	0.88	18.0	82.0	
[2] Beef, ribs boiled, 1169[3]	Small serving	30.0	1.1	27.0	73.0	
[2] Beef, ribs boiled, 1170[3]	Very small serving	25.0	0.87	21.0	79.0	
[1] Calf's foot jelly, as purchased	....	112.0	4.0	19.0	..	81.0
[1] Chicken, as purchased, canned	One thin slice	27.0	0.96	23.0	77.0	
[1] Lamb chops, boiled, edible portion, average	One small chop	27.0	0.96	24.0	76.0	
[1] Lamb, leg, roast	Ordinary serving	50.0	1.8	40.0	60.0	
[2] Mutton, leg, boiled, 1184[3]	Large serving	34.0	1.2	35.0	65.0	
[2] Pork, ham, boiled (fat) 1174[3]	Small serving	20.5	0.73	14.0	86.0	
[2] Pork, ham, boiled, 1192[3]	Ordinary serving	32.5	1.1	28.0	72.0	
[2] Pork, ham, roasted (fat), 1484[3]	Small serving	27.0	0.96	19.0	81.0	
[2] Pork, ham, roasted (lean), 1511[3]	Small serving	34.0	1.2	33.0	67.0	
[1] Turkey, as purchased, canned	Small serving	28.0	0.99	23.0	77.0	
[2] Veal, leg, boiled, 1182[3]	Large serving	67.5	2.4	73.0	27.0	

UNCOOKED MEATS.						
[1] Beef, loin, edible portion, average (lean)	Ordinary serving	50.0	1.8	40.0	60.0	
[1] Beef, loin, edible portion, average (fat)	Small serving	30.0	1.1	22.0	78.0	
[1] Beef, loin, porterhouse steak, edible portion, average	Small steak	36.0	1.3	32.0	68.0	
[1] Beef, loin, sirloin steak, edible portion, average	Small steak	40.0	1.4	31.0	69.0	
[1] Beef, ribs, lean, edible portion, average	Ordinary serving	52.0	1.8	42.0	58.0	
[1] Beef, round, lean, edible portion, average	Ordinary serving	63.0	2.2	54.0	46.0	
[1] Beef, tongue, edible portion, average	Ordinary serving	62.0	2.2	47.0	53.0	
[1] Beef, juice	....	395.0	14.0	78.0	22.0	
[1] Chicken (broilers), edible portion, average	Large serving	90.0	3.2	79.0	21.0	
[1] Clams, round, in shell, edible portion, average	Twelve to sixteen	210.0	7.4	56.0	8.0	36.0
[1] Cod, whole, edible portion	Two servings	138.0	4.9	95.0	5.0	
[1] Goose (young), edible portion, average	Half serving	25.0	0.88	16.0	84.0	
[1] Halibut steaks or section, edible portion, average	Ordinary serving	81.0	2.8	61.0	39.0	
[1] Liver (veal), as purchased, average	Two small servings	79.0	2.8	61.0	39.0	
[1] Lobsters, whole, edible portion, average	Two servings	117.0	4.1	78.0	20.0	2.0
[1] Mackerel (Spanish), whole, edible portion, average	Ordinary serving	57.0	2.0	50.0	50.0	
[1] Mutton leg, hind, lean, edible portion, average	Ordinary serving	50.0	1.8	41.0	59.0	
[1] Oysters, in shell, edible portion, average	One dozen	193.0	6.8	49.0	22.0	29.0
[1] Pork, loin chops, edible portion, average	Very small serving	27.0	0.97	18.0	82.0	
[1] Pork, ham, smoked, lean, edible portion, average	Small serving	36.0	1.3	29.0	71.0	
Pork, bacon, smoked, med. fat, edible portion, average	Small serving	15.0	0.53	6.0	94.0	
[1] Salmon (California), anterior section, edible portion, av.	Small serving	42.0	1.5	30.0	70.0	
Shad, whole, edible portion, average	Ordinary serving	60.0	2.1	46.0	54.0	
[1] Trout, brook, whole, edible portion, average	Two small servings	100.0	3.6	80.0	20.0	
[1] Turkey, edible portion, average	Two small servings	23.0	1.2	29.0	71.0	
VEGETABLES.						
[1] Artichokes, as purchased, average, canned	....	430.0	15.0	14.0	..	86.0
[1] Asparagus, as purchased, average, canned	....	540.0	19.0	33.0	5.0	62.0
[1] Asparagus, as purchased, average, cooked	....	206.0	7.19	18.0	63.0	19.0
[1] Beans, baked, canned	Small side dish	75.0	2.66	21.0	18.0	61.0
[1] Beans, Lima, canned	Large side dish	126.0	4.44	21.0	4.0	75.0
[1] Beans, string, cooked	Five servings	480.0	16.66	15.0	48.0	37.0
[1] Beets, edible portion, cooked	Three servings	245.0	8.7	2.0	23.0	75.0
[1] Cabbage, edible portion	....	310.0	11.0	20.0	8.0	72.0
[1] Carrots, edible portion, average, fresh	....	215.0	7.6	10.0	8.0	82.0
Carrots, cooked	Two servings	164.0	5.81	10.0	34.0	56.0

TABLE OF FOODS GIVING THE WEIGHT (IN GRAMS, OUNCES AND ROUGH MEASURE) OF A "STANDARD PORTION" OF EACH FOOD AND THE NUMBER OF CALORIES IN THAT "PORTION" IN THE FORM OF PROTEID, FAT AND CARBOHYDRATE.—*Continued.*

Name of food.	"Portion" containing 100 calories roughly described.	Weight of 100 calories.		Per cent. of		
		Grams.	Ounces.	Proteid.	Fat.	Carbohydrate.
VEGETABLES.—*Continued.*						
[1] Cauliflower, as purchased, average	....	312.0	11.0	23.0	15.0	62.0
[1] Celery, edible portion, average	....	540.0	19.0	24.0	5.0	71.0
Corn, sweet, cooked	One side dish	99.0	3.5	13.0	10.0	77.0
[1] Cucumbers, edible portion, average	....	565.0	20.0	18.0	10.0	72.0
[1] Egg plant, edible portion, average	....	350.0	12.0	17.0	10.0	73.0
Lentils, cooked	....	89.0	3.15	27.0	1.0	72.0
[1] Lettuce, edible portion, average	....	505.0	18.0	25.0	14.0	61.0
[1] Mushrooms, as purchased, average	....	215.0	7.6	31.0	8.0	61.0
[1] Onions, fresh, edible portion, average	....	200.0	7.1	13.0	5.0	82.0
[1] Onions, cooked	Two large servings	240.0	8.4	12.0	40.0	48.0
[1] Parsnips, edible portion, average	One and a half serving	152.0	5.3	10.0	7.0	83.0
Parsnips, cooked	....	163.0	5.84	10.0	34.0	56.0
[1] Peas, green, canned	Two servings	178.0	6.3	25.0	3.0	72.0
[1] Peas, green, cooked	One serving	85.0	3.0	23.0	27.0	50.0
Potatoes, baked	One good sized	86.0	3.05	11.0	1.0	88.0
[1] Potatoes, boiled	One large sized	102.0	3.62	11.0	1.0	88.0
[1] Potatoes, mashed (creamed)	One serving	89.0	3.14	10.0	25.0	65.0
Potatoes, steamed	One serving	101.0	3.57	11.0	1.0	88.0
[1] Potatoes, chips	One-half serving	17.0	0.6	4.0	63.0	33.0
[1] Potatoes, sweet, cooked	Half of av. potato	49.0	1.7	6.0	9.0	85.0
[1] Pumpkins, edible portion, average	....	380.0	12.0	15.0	4.0	81.0
Radishes, as purchased	....	480.0	17.0	18.0	3.0	79.0
Rhubarb, edible portion, average	....	430.0	15.0	10.0	27.0	63.0

[1] Spinach, cooked, as purchased	Two ordinary servings	174.0	6.1	15.0	66.0	19.0
[1] Squash, edible portion, average	....	210.0	7.4	12.0	10.0	78.0
[1] Succotash, canned, as purchased, average	Ordinary serving	100.0	3.5	15.0	9.0	76.0
[1] Tomatoes, fresh, as purchased, average	Four av. tomatoes	430.0	15.0	15.0	16.0	69.0
Tomatoes, canned	....	431.0	15.2	21.0	7.0	72.0
[1] Turnips, edible portion, average	Two large servings	246.0	8.7	13.0	4.0	83.0
Vegetable oysters	....	273.0	9.62	10.0	51.0	39.0
DAIRY PRODUCTS.						
[1] Butter, as purchased	Ordinary pat or ball	12.5	0.41	0.5	99.5	
[1] Buttermilk, as purchased	1½ glass	275.0	9.7	34.0	12.0	54.0
[1] Cheese, American, pale, as purchased	1½ cubic in.	22.0	0.77	25.0	73.0	2.0
[1] Cheese, cottage, as purchased	¼ cubic in.	89.0	3.12	76.0	8.0	16.0
[1] Cheese, full cream, as purchased	1½ cubic in.	23.0	0.82	25.0	73.0	2.0
[1] Cheese, Neufchatel, as purchased	1½ cubic in.	29.5	1.05	22.0	76.0	2.0
[1] Cheese, Swiss, as purchased	1½ cubic in.	23.0	0.8	25.0	74.0	1.0
[1] Cheese, pineapple, as purchased	1½ cubic in.	20.0	0.72	25.0	73.0	2.0
[1] Cream	½ ordinary glass	49.0	1.7	5.0	86.0	9.0
[1] Kumyss	....	188.0	6.7	21.0	37.0	42.0
[1] Milk, condensed, sweetened, as purchased	....	30.0	1.06	10.0	23.0	67.0
[1] Milk, condensed, unsweetened (evaporated cream) as purchased	....	59.0	2.05	24.0	50.0	26.0
[1] Milk, skimmed, as purchased	1½ glass	255.0	9.4	37.0	7.0	56.0
[1] Milk, whole, as purchased	Small glass	140.0	4.9	19.0	52.0	29.0
[1] Whey, as purchased	Two glasses	360.0	13.0	15.0	10.0	75.0
FRUITS (DRIED).						
[1] Apples, as purchased, average	....	34.0	1.2	3.0	7.0	90.0
Apricots, as purchased, average	....	35.0	1.24	7.0	3.0	90.0
[1] Dates, edible portion, average	Three large	28.0	0.99	2.0	7.0	91.0
[1] Dates, as purchased	....	31.0	1.1	2.0	7.0	91.0
[1] Figs, edible portion, average	One large	31.0	1.1	5.0	..	95.0
[1] Prunes, edible portion, average	Three large	32.0	1.14	3.0	..	97.0
[1] Prunes, as purchased	....	38.0	1.35	3.0	..	97.0
[1] Raisins, edible portion, average	....	28.0	1.0	3.0	9.0	88.0
[1] Raisins, as purchased	....	31.0	1.1	3.0	9.0	88.0

TABLE OF FOODS GIVING THE WEIGHT (IN GRAMS, OUNCES AND ROUGH MEASURE) OF A "STANDARD PORTION" OF EACH FOOD AND THE NUMBER OF CALORIES IN THAT "PORTION" IN THE FORM OF PROTEID, FAT AND CARBOHYDRATE.—*Continued.*

Name of food.	"Portion" containing 100 calories roughly described.	Weight of 100 calories.		Per cent. of		
		Grams.	Ounces.	Proteid.	Fat.	Carbohydrate.
FRUITS (FRESH OR COOKED).						
[1] Apples, as purchased	Two apples	206.0	7.3	3.0	7.0	90.0
Apples, baked	....	94.0	3.3	2.0	5.0	93.0
Apples, sauce	Ordinary serving	111.0	3.9	2.0	5.0	93.0
[1] Apricots, edible portion, average	....	168.0	5.92	8.0	..	92.0
Apricots, cooked	Large serving	131.0	4.61	6.0	..	94.0
[1] Bananas, yellow, edible portion, average	One large	100.0	3.5	5.0	5.0	90.0
[1] Blackberries, as purchased, average	....	170.0	5.9	9.0	16.0	75.0
Blueberries	....	128.0	4.6	3.0	8.0	89.0
[1] Blueberries, canned, as purchased	....	165.0	5.8	4.0	9.0	87.0
Cantaloups	Half ord. serving	243.0	8.6	6.0	..	94.0
[1] Cherries, edible portion, average	....	124.0	4.4	5.0	10.0	85.0
[1] Cranberries, as purchased, average	....	210.0	7.5	3.0	12.0	85.0
[1] Grapes, as purchased, average	....	136.0	4.8	5.0	15.0	80.0
Grapefruit	....	215.0	7.57	7.0	4.0	89.0
Grape juice	Small glass	120.0	4.2	..	..	100.0
Gooseberries	....	261.0	9.2	5.0	..	95.0
[1] Lemons	....	215.0	7.57	9.0	14.0	77.0
Lemon juice	....	246.0	8.77	..	..	100.0
Nectarines	....	147.0	5.18	4.0	..	96.0
Olives, ripe	About seven olives	37.0	1.31	2.0	91.0	7.0
[1] Oranges, as purchased, average	One very large	270.0	9.4	6.0	3.0	91.0
Oranges, juice	Large glass	188.0	6.62	..	..	100.0
[1] Peaches, as purchased, average	Three ordinary	290.0	10.0	7.0	2.0	91.0
Peaches, sauce	Ordinary serving	136.0	4.78	4.0	2.0	94.0
Peaches, juice	Ordinary glass	136.0	4.8	..	..	100.0
[1] Pears	One large pear	173.0	5.4	4.0	7.0	89.0
Pears, sauce	....	113.0	3.98	3.0	4.0	93.0

[1] Pineapples, edible portion, average	....	226.0	8.0	4.0	6.0	90.0
Raspberries, black	....	141.0	5.18	10.0	14.0	76.0
Raspberries, red	....	178.0	6.29	8.0	..	92.0
[1] Strawberries, as purchased, average	Two servings	260.0	9.1	10.0	15.0	75.0
[1] Watermelon, as purchased, average	....	760.0	27.0	6.0	6.0	88.0
CAKES, PASTRY, PUDDING AND DESSERTS.						
[1] Cake, chocolate layer, as purchased	Half ord. square piece	28.0	0.98	7.0	22.0	71.0
[1] Cake, gingerbread, as purchased	Half ord. square piece	27.0	0.96	6.0	23.0	71.0
[1] Cake, sponge, as purchased	Small piece	25.0	0.89	7.0	25.0	68.0
Custard, caramel	....	71.0	2.51	19.0	10.0	71.0
Custard, milk	Ordinary cup	122.0	4.29	26.0	56.0	18.0
Custard, tapioca	Two-thirds ordinary	69.5	2.45	9.0	12.0	79.0
[1] Doughnuts, as purchased	Half a doughnut	23.0	0.8	6.0	45.0	49.0
[1] Lady fingers, as purchased	....	27.0	0.95	10.0	12.0	78.0
[1] Macaroons, as purchased	....	23.0	0.82	6.0	33.0	61.0
[1] Pie, apple, as purchased	One-third ord. piece	38.0	1.3	5.0	32.0	63.0
[1] Pie, cream, as purchased	One-fourth ord. piece	30.0	1.1	5.0	32.0	63.0
[1] Pie, custard, as purchased	One-third ord. piece	55.0	1.9	9.0	32.0	59.0
[1] Pie, lemon, as purchased	One-third ord. piece	38.0	1.35	6.0	36.0	58.0
[1] Pie, mince, as purchased	One-fourth ord. piece	35.0	1.2	8.0	38.0	54.0
[1] Pie, squash, as purchased	One-third ord. piece.	55.0	1.9	10.0	42.0	48.0
Pudding, apple sago	....	81.0	3.02	6.0	3.0	91.0
Pudding, brown betty	Half ord. serving	56.6	2.0	7.0	12.0	81.0
Pudding, cream rice	Very small serving	75.0	2.65	8.0	13.0	79.0
Pudding, Indian meal	Half ord. serving	56.6	2.0	12.0	25.0	63.0
Pudding, apple tapioca	Small serving	79.0	2.8	1.0	1.0	98.0
Tapioca, cooked	Ordinary serving	108.0	3.85	1.0	1.0	98.0
SWEETS AND PICKLES.						
[1] Catsup, tomato, as purchased, average	....	170.0	6.0	10.0	3.0	87.0
[1] Honey, as purchased	Four teaspoonfuls	30.0	1.05	1.0	..	99.0
[1] Marmalade (orange peel)	....	28.3	1.0	0.5	2.5	97.0
[1] Molasses, cane	....	35.0	1.2	0.5	..	99.5
[1] Olives, green, edible portion	Seven olives	32.0	1.1	1.0	84.0	15.0
[1] Olives, ripe, edible portion	Seven olives	38.0	1.3	2.0	91.0	7.0
[1] Pickles, mixed, as purchased	....	415.0	14.6	18.0	15.0	67.0
[1] Sugar, granulated	Three teaspoonfuls or 1½ lumps	24.0	0.86	..	..	100.0
[1] Sugar, maple	Four teaspoonfuls	29.0	1.03	..	..	100.0
[1] Syrup, maple	Four teaspoonfuls	35.0	1.2	..	..	100.0

TABLE OF FOODS GIVING THE WEIGHT (IN GRAMS, OUNCES AND ROUGH MEASURE) OF A "STANDARD PORTION" OF EACH FOOD AND THE NUMBER OF CALORIES IN THAT "PORTION" IN THE FORM OF PROTEID, FAT AND CARBOHYDRATE.—*Continued.*

Name of food.	"Portion" containing 100 calories roughly described.	Weight of 100 calories.		Per cent. of		
		Grams.	Ounces.	Proteid.	Fat.	Carbohydrate.
NUTS.						
[1] Almonds, edible portion, average	About eight	15.0	0.53	13.0	77.0	10.0
[1] Beechnuts	....	14.8	0.52	13.0	79.0	8.0
[1] Brazil nuts, edible portion	Three ord. size	14.0	0.49	10.0	86.0	4.0
[1] Butternuts	....	14.0	0.5	16.0	82.0	2.0
[1] Cocoanuts	....	16.0	0.57	4.0	77.0	19.0
[1] Chestnuts, fresh, edible portion, average	....	40.0	1.4	10.0	20.0	70.0
[1] Filberts, edible portion, average	Ten nuts	14.0	0.48	9.0	84.0	7.0
[1] Hickory nuts	....	13.0	0.47	9.0	85.0	6.0
[1] Peanuts, edible portion, average	Thirteen double	18.0	0.62	20.0	63.0	17.0
[1] Pecans, polished, edible portion	About eight	13.0	0.46	6.0	87.0	7.0
[1] Pine nuts (pignolias), edible portion	About eighty	16.0	0.56	22.0	74.0	4.0
[1] Walnuts, California, edible portion	About six	14.0	0.48	10.0	83.0	7.0
CEREALS.						
[1] Bread, brown, as purchased, average	Ordinary thick slice	43.0	1.5	9.0	7.0	84.0
[1] Bread, corn (johnny cake), as purchased, average	Small square	38.0	1.3	12.0	16.0	72.0
[1] Bread, white, home-made, as purchased	Ordinary thick slice	38.0	1.3	13.0	6.0	81.0
Corn flakes, toasted	Ord. cereal dish full	27.0	0.97	11.0	1.0	88.0

[1] Corn meal, granular, average	....	27.0	0.96	10.0	5.0	85.0
[1] Corn meal, unbolted, edible portion, average	....	26.0	0.92	9.0	11.0	80.0
[1] Crackers, graham, as purchased	Two crackers	23.0	0.82	9.0	20.0	71.0
[1] Crackers, oatmeal, as purchased	Two crackers	23.0	0.71	11.0	24.0	65.0
[1] Hominy, cooked	Large serving	120.0	4.2	11.0	2.0	87.0
[1] Macaroni, average	....	27.0	0.96	15.0	2.0	83.0
[1] Macaroni, average, cooked	Ordinary serving	110.0	3.85	14.0	15.0	71.0
[1] Oatmeal, average, boiled	1½ serving	159.0	5.6	18.0	7.0	75.0
[1] Popcorn, average	....	24.0	0.86	11.0	11.0	78.0
[1] Rice, uncooked	....	28.0	0.98	9.0	1.0	90.0
[1] Rice, boiled, average	Ord. cereal dish	87.0	3.1	10.0	1.0	89.0
[1] Rice, flakes	Ord. cereal dish	27.0	0.94	8.0	1.0	91.0
[1] Rolls, Vienna, as purchased, average	One large roll	35.0	1.2	12.0	7.0	81.0
[1] Shredded wheat	One biscuit	27.0	0.94	13.0	4.5	82.5
[1] Spaghetti, average	.....	28.0	0.97	12.0	1.0	87.0
[1] Wheat flour, entire wheat, average	....	27.0	0.96	15.0	5.0	80.0
[1] Wheat flour, graham, average	....	27.0	0.96	15.0	5.0	80.0
[1] Wheat flour, patent roller process, family and straight grade spring wheat, average	....	27.0	0.97	12.0	3.0	85.0
[1] Zwieback	Size of thick slice of bread	23.0	0.81	9.0	21.0	70.0
Miscellaneous.						
[1] Eggs, hen's, boiled	One large egg	58.0	2.1	32.0	68.0	
[1] Eggs, hen's, whites	....	181.0	6.4	100.0		
[1] Eggs, hen's, yolks	Two yolks	27.0	0.94	17.0	83.0	
Omelet	....	94.0	3.3	34.0	60.0	6.0
[1] Soup, beef, as purchased, average	....	380.0	13.0	69.0	14.0	17.0
[1] Soup, bean, as purchased, average	Very large plate	150.0	5.4	20.0	20.0	60.0
[1] Soup, cream of celery, as purchased, average	Two plates	180.0	6.3	16.0	47.0	37.0
[1] Consomme, as purchased	....	830.0	29.0	85.0	..	15.0
[1] Clam chowder, as purchased	Two plates	230.0	8.25	17.0	18.0	65.0

[1] Chemical Composition of American Food Materials, Atwater and Bryant, U. S. Department of Agriculture, Bull. No. 28.

[2] Experiments on Losses in Cooking Meats (1900–03), Grindley, U. S. Department of Agriculture, Bull. No. 141.

[3] Laboratory number of specimen, as per Experiments on Losses in Cooking Meat.

This table is an extract from an article on "Practical Dietetics," by Prof. Irving Fisher. Ten cents per copy. American Medical Association, Chicago.

Amount of Proteid Required.—Fat and carbohydrates furnish energy and are not concerned in tissue building. Proteid forms tissue and in addition furnishes energy. However, proteid is an inefficient fuel, so that so far as possible only sufficient proteid should be furnished to replace daily wear and tear, leaving the energy to be supplied by fats and carbohydrates. Chittenden believed that health and strength may be maintained on 0.94 gram of protein per kilo of body weight (156 pounds = 70 kilos). If labor is not very severe this may be sufficient. The protein requirement is given up to 2 grams per kilo by various authors. It must be remembered that the body requirement of protein does not necessarily depend upon protein *per se* but upon useful protein. A complete protein contains about 17 amino acids. Most animal proteins are complete, while many vegetable proteins are not. Therefore if the protein intake is from vegetable sources, it may be necessary to consume several times the actual amount of protein katabolized. There is no direct evidence that an excess of protein is injurious, while there is plenty of evidence that a deficiency in protein is injurious. For these reasons, especially when dealing with soldiers performing hard work, it is not believed that Voit's standard should be materially lowered. It is well to remember, however, that under the pinch of necessity this amount of protein can be reduced to Chittenden's standard or even lower for short periods.

The relative proportion of the food constituents in well-ordered dietaries is usually set down as about one part protein, half a part of fat, and four parts of carbohydrates, or a proportion of nitrogen to carbon of 1 to 16 or 1 to 18.

Daily food requirements for a man of 156 *pounds* (70 *kilos*):

Chittenden.	Grams.	Calories.
Protein	60	246
Fat	60	558
Carbohydrate	500	2050
Total		2854

Voit.	Grams.	Calories.
Protein	118	483
Fat	56	538
Carbohydrate	500	2050
Total		3071

Melville (standard for ordinary man).	Grams.	Calories.
Protein	120	490
Fat	60	558
Carbohydrate	480	1970
Total		3018

Melville (standard for hard labor).	Grams.	Calories.
Protein	170	697
Fat	180	1674
Carbohydrate	530	2173
Total		4544

The U. S. Army Ration; Garrison Ration.—By selecting such articles as bacon, hard bread, cornmeal, beans, potatoes, dried fruit, butter and syrup a maximum fuel value of from 5378 to 5674 calories may be obtained. By using such articles as dried fish, soft bread, rice, potatoes, onions, canned tomatoes and dried fruit the fuel value can be reduced to 2500 calories. The average garrison ration of fresh beef, soft bread, beans, potatoes, onions, dried fruit, butter and syrup and sugar weighs 65 ounces and has a fuel value of 3536 calories distributed as follows:

	Grams.	Calories.
Protein	157	643
Fat	99	921
Carbohydrate	481	1972
Total		3536

Haversack ration.	Grams.	Calories.
Protein	113	463
Fat	218	2027
Carbohydrate	489	2004
Total		4494

The travel ration gives a fuel value of about 2735 calories.

The Filipino ration gives a fuel value of about 3980 calories.

When for any reason the ration must be cut down, the following is suggested:

	Ounces.	Calories.
Cooked beans	14¾	800
Pork	2	468
Bread	5	360
Butter	1	206
Milk	10	200
Coffee	5	
Total		2034

Sixteen per cent. of these calories are in protein, one-sixth being animal proteins complete Grade A.

DEFICIENCY DISEASES.

Deficiency diseases have appeared in some of the prison camps in Europe, and have been very common in jails, asylums, and similar institutions in the United States. The commonest cause of these diseases appears to have been the too exclusive use of finely milled wheat flour over long periods of time. Certain foods are now known to be deficient in certain substances that have been called vitamines, and the prolonged deprivation of these substances results in such diseases as scurvy, beriberi and possibly pellagra. When large bodies of prisoners must be fed, an observance of the following rules will prevent the development of these deficiency diseases.

1. When bread is the staple article of diet it should be made from whole wheat.

2. When rice is used in any quantity, undermilled rice should be used.

3. Beans, peas or other legumes should be used once a week. These are not to be canned, but may be dried.

4. Some fresh vegetable or fruit to be issued at least once and preferably twice a week.

5. Barley should be used in soups.

6. White potatoes and fresh meat should be served at least once a week and preferably daily.

7. The too exclusive use of canned foods is to be avoided.

8. If cornmeal is used it should be made from the whole grain.

WATER.

Minimum Requirement in Camp.—Each man requires daily at least 1 quart for drinking, and 2½ quarts for drinking and cooking. One gallon more should be allowed for washing his person and clothing. In the tropics and warm climates this amount must be increased by at least one-third. In semipermanent camps not less than 5 gallons per capita should be provided, while in permanent camps with bath houses and sewerage not less than 30 gallons must be provided. In estimating for cavalry commands it may be considered that a horse will drink about 8 gallons a day.

Tests for Purity.—In permanent camps the water may be assumed to be pure unless there is specific information to the contrary. It is hardly to be supposed that a permanent camp site would be selected that afforded only an impure water. However, should the water be suspected, samples may be sent to the nearest Department Laboratory in accordance with the provisions in the following circular from the Office of the Surgeon-General. In semipermanent camps the water may be sent in to be tested in the same way, or if this is impracticable it may be tested by a field laboratory. In the absence of tests establishing the purity of the water supply all drinking water should be purified. See note on Purification of Water.

W. D., Office of the Surgeon-General, Washington, August 18, 1910. The following directions for the collection of

samples of water for bacteriological examination are published for the information and guidance of all whom it may concern:

All samples of water intended for bacteriological examination should be collected by a medical officer in the sterilized bottles furnished with mailing cases, upon request to this office, for the purpose. These bottles are previously sterilized and are protected by a piece of heavy sterilized muslin secured by a copper wire which is also intended to keep the stopper securely in place during transportation.

To collect the sample, first untwist the projecting ends of the copper wire to release the stopper; the stopper may then be loosened, but it must not be removed. If the specimen is to be taken from a faucet or pump, the water should be permitted to run for fifteen to twenty minutes, then allowing a small, gentle stream to flow, grasp the bottle near the bottom and removing the stopper, permit the stream to flow into the bottle, held in the upright position, until it is filled to the shoulder. Then replace the stopper, screwing it in tightly, and secure both stopper and cloth by carrying the wire several times around the neck of the bottle and twisting the ends securely. The stopper must be handled only by the square cloth-covered top and the lip of the bottle must not be brought in contact with the faucet or spout, nor should the neck of the bottle or naked part of the stopper be permitted to come in contact with any object during the manipulation. The projecting flange is designed to protect the plug of the stopper, which it will do if the stopper, after withdrawal, is held by the top in a vertical position. The stopper should not be laid down and the cloth should not be handled by the fingers except in the act of securing the wire about it. When well water is to be examined the bottle should be filled directly from the bucket constantly in use for drawing the water and from no other vessel. The label should be plainly marked to show the source from which the sample is taken and the date of collection. A little cotton should be placed in the

bottom of the mailing case to insure that the bottle will be held firmly in position. The sample should be plainly marked "Water for bacteriological examination" and forwarded at the earliest moment, by mail to the nearest Department Laboratory. On account of the labor involved and the possibility of error, bacteriological examinations of water collected in any other than the prescribed receptacles will not be made.

GEO. H. TORNEY,
Surgeon-General, U. S. Army.

MILK, SANITARY SUPERVISION.

The objects to be attained by sanitary control of milk supplies are:

1. Competent veterinary examination of dairy cattle and elimination of those found diseased. Tuberculosis especially is excluded by the tuberculin test, and cows having mastitis or inflammation of the udder should be excluded. The streptococcus from this condition is very possibly the cause of "septic sore throat."

2. Cleanliness of stables, animals, utensils, and especially of the methods of production and handling of milk from the cow to the consumer.

3. Maintenance of the milk continuously at a sufficiently low temperature (at least 50° F.). Prohibition of sale of milk that is stale or shows an excessive bacterial count.

4. Sufficient food values and freedom from adulteration, sophistication, or the use of preservatives.

5. Prevention of infection, human or animal in source, through requirements as to health of employees, reporting of communicable diseases in the families of any persons concerned in the handling of milk, regulations as to the delivery of milk to infected families (only in bottles, never in bulk), purity of dairy water supplies, proper sterilization of milk

bottles and apparatus, and pasteurization of all milk except that of the very highest grade.

This control is exercised by:

1. Inspection at dairy farm, bottling establishments, during transportation and while on sale. A score-card system is used in many cities to indicate relative purity of various dairies, and this is published. The public will not care to buy poor milk. In the military service, milk from insanitary dairies should not be permitted to be sold on military reservations.

2. Laboratory control, including collection of samples, bacterial counts, chemical tests, tests for visible dirt, and tests for adulterations and preservatives. Samples of milk, as far as possible in original containers, may be sent packed in ice to the nearest Department Laboratory for a bacterial count, providing not more than twenty-four hours are required in transit, as the bacterial count is worthless in old milk. When this cannot be done, the milk may be examined on the ground by a medical officer, as the technic is very simple. The following standard method should be used.

Method.—Clean cap and shake bottle vigorously before opening. Shaking is important, since the majority of bacteria rise with the cream. For samples of unknown character make dilutions of 1 to 100, 1 to 1000, and 1 to 10,000, using sterile water and pipettes. These dilutions may be made by setting up four test-tubes containing 9 c.c. of sterile water. In the first tube place 1 c.c. of the milk to be tested, making a dilution of 1 to 10. Mix well and carry 1 c.c. to the second tube, making a dilution of 1 to 100. By the same process tube 3 makes a dilution of 1 to 1000 and tube 4 a dilution of 1 to 10,000. One c.c. of the last three dilutions are plated. Place the milk in a sterile Petri dish and pour in a tube of melted agar that has been cooled to 50° C. Invert the plates after they have hardened and incubate

for forty-eight hours, after which the colonies are counted, using a small hand lens if possible.

Grading Milk.—Some standard is necessary. The following, used by the New York Board of Health, is excellent.

Grade A.—Milk for infants to drink: If used raw must not contain more than 60,000 bacteria per cubic centimeter. If pasteurized must not contain more than 200,000 before pasteurization and not more than 30,000 after pasteurization.

Grade B.—Milk for adults to drink: Is all pasteurized and should not contain more than 1,500,000 bacteria per cubic centimeter before pasteurization and not more than 100,000 after pasteurization.

Grade C.—Milk for cooking only: All pasteurized, and must not contain more than 300,000 bacteria per cubic centimeter after pasteurization.

Milk used by soldiers should all be pasteurized. Efficient pasteurization destroys practically all disease organisms, including those of typhoid, foot-and-mouth disease, septic sore throat, and other diseases that may be milk-borne. If camps are located where a pasteurized supply cannot be obtained it would be wise to use only canned milk or to have all milk pasteurized at the hospital under the supervision of the surgeon.

Pasteurization.—Several firms make pasteurizers capable of handling 20 gallons and up. Most of these depend upon the use of electric or other power for stirring the milk. The American Pasteurizer Company, of Washington, D. C., has under construction a small apparatus that can be used at hospitals. This apparatus will pasteurize milk in bottles, will be heated by an oil stove, and the entire apparatus packs into the pasteurizer tank, which is 4 feet long, 2 feet high, and 15 inches wide. The entire apparatus, including oil stove, will cost in the neighborhood of $100.

A pasteurizer can be improvised from a wash boiler or similar water container. The milk bottles or cans are stood

on bricks in the container, water is poured into the container up to the neck of the cans or to the lip of the bottles. The water is heated while the milk is stirred until the temperature of the milk is 145° F. This temperature is maintained for half an hour, after which the hot water is drawn off and the milk is rapidly cooled to 45° F. or less by pouring cold water into the container. The milk is then placed in the ice-box.

The Investigation of Supposed Milk-borne Epidemics.— Cover the following points:

1. The number of cases of the disease existing in the territory involved during the time covered by the epidemic.
2. The number and location of houses invaded by the disease.
3. The number of invaded houses supplied in whole or in part, directly or indirectly with the suspected milk.
4. The number of cases occurring in the invaded houses so supplied.
5. The total number of houses supplied with the suspected milk.
6. The relative proportion of houses so supplied to those supplied by other dairies.
7. The time covered by the epidemic.
8. The location of the case or cases from which the milk became infected, and the relation of this case to the milk.
9. The time relation of the original case to the epidemic.
10. The special incidence of the disease among milk drinkers, and among those using the particular milk supply investigated.
11. The elimination by a process of exclusion of other common means of transmission of the disease in question.
12. The effect upon the epidemic of closing the dairy, or of taking such measures as would prevent future contamination from the suspected source.
13. The finding of the specific organism in the milk.

DISPOSAL OF WASTES.

ROCK-PILE CREMATORY.—For the general use of a regimental or brigade camp where fuel and stones are plentiful, and in the absence of special appliances, there is nothing better than this type of crematory for the incineration of garbage and refuse, solid and liquid. It is thus described in specifications from the office of the Chief of the Quartermaster Corps, January, 1908.

At some convenient location a circular pit is dug, 3 feet in depth and 15 feet in diameter. The bottom to be covered with loose stones to the depth of 14 to 16 inches. On this is built a circular wall to the height of 1 foot above the original

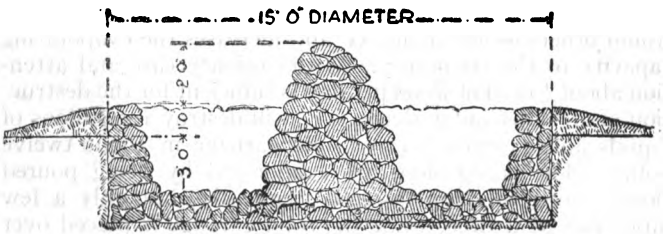

FIG. 1.—Rock-pile crematory.

ground line, and the excavated earth is packed against it clear to the top so as to provide a sloping approach and thereby prevent surface water gaining access to the pit. A pyramid of large stones, 4 or 5 feet high, occupies the center. This feature is essential to provide central draft and steady fire.

The bottom stones receive the liquid portions of the garbage without affecting the fire, and soon evaporate and dissipate them. The solid portions are soon desiccated and become fuel. Care should be exercised to empty the garbage into and not around the crematory. It is desirable to

place a few heavy stones along the edge of the pit to serve as bumpers or guard to the rear wheels of carts.

This crematory has been repeatedly used and has given general satisfaction. Only one man is required for its service. One cord of wood will consume approximately 4500 pounds of refuse and garbage, including kitchen wastes and slops. It will likewise incinerate manure and dead animals. (From Havard, Military Hygiene.)

THE COMPANY INCINERATOR.—The following was designed by Major Straub, M.C. It consists of a bed of rocks level with the ground, 1 foot deep, 3 feet wide, and $4\frac{1}{2}$ feet long, surrounded with a sloping stone wall 18 inches high except at one end, which is left open for draught, fuel, and access to the fire. The stone wall absorbs much of the heat that would otherwise be dissipated and increases the evaporating capacity of the crematory. With ordinary care and attention about $\frac{1}{6}$ cord of wood per day is sufficient for the destruction of all slops and garbage, *i. e.*, will destroy 100 gallons of liquids and 23 cubic feet of solid garbage in about twelve hours. The liquid slops are evaporated by being poured slowly along the sloping walls frequently, but only a few dipperfuls at a time, while the solid garbage is placed over the fire-bed on top of the fuel. When liquids are excessive they may be partly evaporated in a tin boiler placed on the fire.

CALDWELL CREMATORY.—Intersecting trenches 10 feet long, 1 foot wide, and 15 inches deep at middle and gradually becoming shallower at each end to the surface level. On the intersection a grate is made and a barrel is placed over the grate. The barrel is lined with clay and burned out so that a chimney is constructed. In place of the barrel, a sheet-iron cylinder may be used when obtainable. Of the various openings, the ones to leeward are closed, and the fire started, after which garbage and waste may be dropped down the chimney. This crematory which can be improvised any-

where will burn the garbage and refuse of a battalion. If the grating is unobtainable the iron cylinder may be used alone by having apertures cut in the base to furnish draught. Another type of incinerator may be made of a grating of railroad iron supported by bricks or stones or a mud wall on three sides.

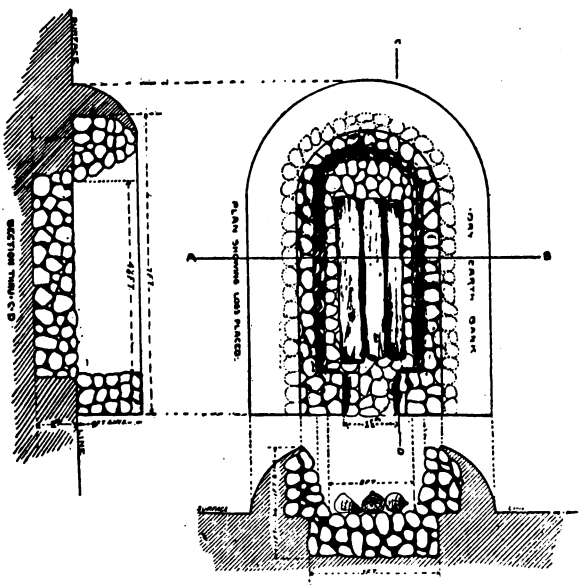

FIG. 2.—The Straub garbage crematory. (From Havard, Military Hygiene.)

The only absolute bar to the use of an incinerator is lack of fuel in a wet climate. Under these conditions some wastes will have to be carried away and buried in deep pits. Such

conditions are very rare, as crude oil can be obtained almost anywhere. A barrel of this oil costs less than the services of one man per day, so it should be used extensively as a matter of economy.

To each infantry regiment, the Quartermaster should assign one wagon daily and three to each cavalry regiment to haul refuse and manure from the kitchens and picket lines to the incinerators. The same wagons may be able to serve several organizations during the day.

The Guthrie incinerator may also be used. A detail drawing for the construction of this incinerator may be found in the Manual for the Quartermaster Corps.

In temporary camps garbage cans are objectionable, and when company incinerators are used are generally forbidden by camp orders. But in permanent camps where incinerators are not used, there is no objection to arrangement with responsible civilians to remove garbage from camps and cantonments provided such removal is prompt and carried out under regulations which will insure that no insanitary conditions result. Garbage to be removed in the can. No dumping into wagons permitted. Returned can to be thoroughly cleansed; sterilization by steam desirable.

When cans are used, they should be kept tightly covered, upon a raised platform so that nothing can accumulate under and between the cans, and the greatest care must be used to avoid soiling of the ground around the cans, as this is certain to attract flies in large numbers.

Disposal of Manure and Care of Picket Lines.—Flies breed preferably in manure, so that particular attention must be given to the manure and refuse from the picket lines and stables. All manure and straw should be hauled away daily and burned or otherwise disposed of as directed by the sanitary inspector. Picket lines will be kept broom swept, and all manure and straw hauled off daily. A weekly incineration of the picket lines will be accomplished with

crude oil at the rate of ten gallons to each line. Crude oil may be obtained from the Quartermaster Corps on usual requisition.

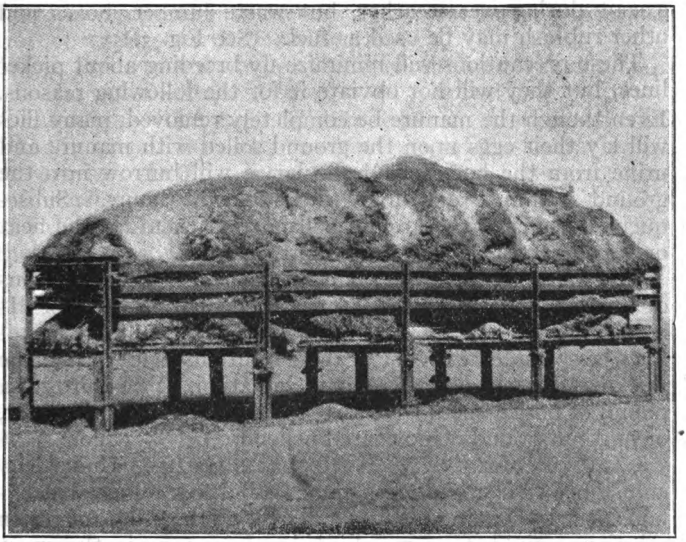

FIG. 3.—Railroad-iron incinerator. This incinerator was partly burned out when the photograph was taken. Ordinarily the manure is piled higher than here indicated. Lewis and Miller, the Military Surgeon, May, 1917.

Manure may be burned in windrows. The space between windrows should be cleaned to the surface of the ground, and the interval between windrows should be sufficient to permit driving between them while one is burning.

In a dry climate a railroad iron incinerator will dispose of from 25 to 50 loads of manure daily. The rails forming

the floor should be laid at right angles to the long axis of the incinerator and parallel to the direction of the prevailing wind. This destroys manure promptly before fly larvæ can escape into the soil. No oil or purchased fuel is necessary except during wet weather, but waste lumber, boxes and other rubbish may be used as fuel. (See Fig. 3.)

These precautions will minimize fly breeding about picket lines, but they will not obviate it for the following reasons. Even though the manure be completely removed, many flies will lay their eggs upon the ground soiled with manure and urine from the horses, and the larvæ will burrow into the ground within twenty-four to forty-eight hours. Subsequent burning of the ground will not kill them for the heat only penetrates the ground a short distance.

The Department of Agriculture has found that solutions of borax or powdered hellebore are efficient larvacides. It is recommended, therefore, that the ground about the picket lines be sprinkled with one of these solutions twice during the week in addition to the weekly incineration. Two-thirds of a pound of borax should be used to each 10 gallons of water, or one-half pound of powdered hellebore per 10 gallons.

CARE OF MANURE IN TEMPORARY CAMPS.—Under circumstances when manure cannot be burned, borax or hellebore may be used as described above. Ten gallons of borax solution sprinkled over 8 bushels of manure is the most effective and least expensive larvacide. If manure is treated in this manner as soon as it accumulates, fly breeding in it will be prevented. The method is only recommended in case incineration is impossible.

Should both of these methods be impracticable, the following method may be used. When manure accumulates in a heap, fermentation causes the temperature to rise in the center of the mass, and after forty-eight hours a temperature of 70 to 90° C. may be found in the center. Turn the heap over so as to bring the surface where the larvæ are, to

the interior of the heap, and the larvæ will be killed at once when they come in contact with the hot parts in the interior. When adding fresh manure, do not add on top of the heap, but bury in the hot parts.

Manure may also be piled on a platform under which is a tray of water. As the larvæ work out at the bottom of the pile in order to burrow into the ground to pupate, they fall into the water and are killed.

LATRINES.—The type of latrine used must necessarily differ in accordance with the location and the character of the service. In permanent camps a water-carriage system or incinerators may be used. Incinerators are not mobile, and this fact together with the cost of installation precludes their use except in permanent camps.

In Semipermanent Camps.—Deep trenches or pits with some form of latrine box are generally used. Such trenches should be 7 or 8 feet deep, 2 feet wide at the mouth and as wide at the bottom as the ground will permit without caving in. A trench 20 feet long will seat 10 men or about 8 per cent. of a company at war strength. The size of the trench must depend upon the type of latrine box to be used, for the box must fit well over the pit in order to be fly-tight. A shelter must be built to ensure privacy and to protect the men from rain. Latrines are located about 50 yards to the rear of the company street.

Latrine Boxes.—Should be made of well-seasoned, tongued and grooved boards of a uniform width and free from knot holes. The holes should be ovoid and have self-closing lids. The box should have handles so that it can be easily carried, and should rest upon a frame so as to make contact with the ground closer and to protect the edges of the pit from wear. A tin strip may be placed to deflect urine away from the box. The latrine box designed by Major Straub and variously modified by Majors Lyster and Miller has been very generally used with satisfactory results.

Major Hopwood has designed another type of box which affords equal accommodation with the use of less material. A urinal trough is not used with this box. These are often difficult to improvise and the connection between the latrine

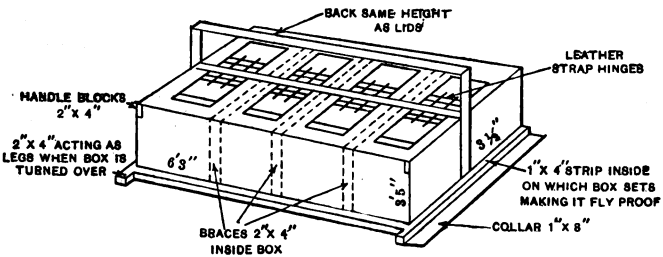
BACK SAME HEIGHT AS LIDS
LEATHER STRAP HINGES
HANDLE BLOCKS 2"x 4"
2"x 4" ACTING AS LEGS WHEN BOX IS TURNED OVER
6'3"
3½"
1"x 4" STRIP INSIDE ON WHICH BOX SETS MAKING IT FLY PROOF
9½"
BRACES 2"x 4" INSIDE BOX
COLLAR 1"x 8"

FIG. 4.—Latrine box used in the camps at Columbus. (Lewis and Miller.)

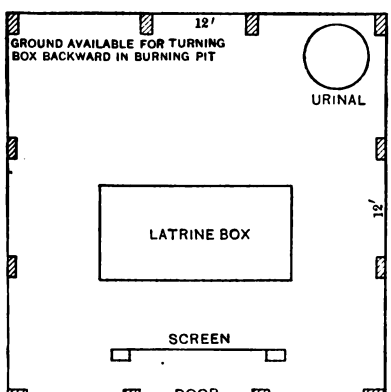

FIG. 5.—Ground plan of latrine box, latrine, screen, and urinal can used at Columbus. (Lewis and Miller.)

box and the urinal is seldom made in a satisfactory manner. A can is therefore used instead. This is a stock article and answers every requirement. Latrine boxes are made by the Quartermaster Corps. They should be inspected on delivery to be sure that they are fly-tight and of proper construction. When made of green lumber they are most unsatisfactory, as they warp and the boards shrink so that cracks appear everywhere through which flies may pass.

Care of Latrines.—(*a*) The latrines will be burned out daily with crude oil and hay. (Each burning, 1 gallon crude oil and 15 pounds hay or straw.)

(*b*) The boxes will at all times be kept fly-tight; this implies closure of all cracks, care of the hinges and back construction so that the lids drop automatically. The latrine seats will be washed daily with soap and water, and washed off twice weekly with a 1 to 100 solution of cresol or other disinfectant.

(*c*) When filled to within 2 feet of the top, latrines will be filled with dirt to within six inches of the surface and covered with a layer of sacking soaked in crude oil to extend three feet beyond the edges of the pit; the latter will then be filled in with earth and the location marked, and new latrines constructed.

In some districts the practice of burning latrine pits has been discontinued and the following method which will be recommended in future orders, is used. The inside of the box and the sides of the pit are thoroughly blackened with a mixture of 1 pound of bone-black and 3 gallons of crude oil. For this purpose a spray pump (F. E. Myers & Bro., Ashland, Ohio, Cat. No. 319, Fig. 1410) is issued to each regiment. The application is repeated every ten days. The contents of the pit are thoroughly covered each day with $1\frac{1}{2}$ gallons of the bone-black-oil mixture, using an ordinary sprinkling can for the purpose. It is claimed that flies do

not enter this pit if ordinary precautions are taken and that the pit does not fill up as rapidly as when burning is resorted to. The urine cans are emptied when the latrine seat is removed for oiling the pit, and are then burned out with one-half pint of crude oil. No more oil should be used or the can will be injured by the heat. After burning out the can, another half-pint of oil is added to form a protective film over the urine subsequently deposited.

Seating Capacity.—Seating capacity for latrines should never be less than 3 per cent. of the command, should be 5 per cent. for small commands under 500 men, and should be 8 to 10 per cent. in permanent camps.

Washing Facilities.—In every latrine a water can with spigot, and several basins with soap should be provided as an essential part of the equipment. Towels can usually not be provided, and every man should carry his own. Washing the hands after leaving the latrine box should be compelled by camp orders in order to prevent contact infection. A basin of tricresol solution may be provided for disinfection of hands.

Improvised Incinerator.—A small barrel may be used as a model for a cement jacket which should be 4 inches thick and 30 inches high; 12 inches from the ground iron bars are inserted to form a grid, and the cylinder and grid should rest upon stones or brick with proper opening for a draught. MacPherson (*Jour. R. A. M. C.*, 1915) has described a simple scheme where by using such an incinerator each man destroyed his own excreta. Empty biscuit tins are cut in half and used as troughs, one for urine and one for feces. Pieces of newspaper are placed in the rear tin. When the man has finished he empties the urine into an absorption pit, and taking hold of the four corners of the paper, places it and its contents in the incinerator. One such incinerator will destroy the feces of 1000 men, but it is essential that any unit using this scheme should be well disciplined and

determined to make it a success. Fuel must be used in the incinerator, preferably coal. If a hot fire is maintained, the excreta are reduced to an impalpable ash. The incinerator and the urine pit or can should be placed near the front of the latrine enclosure, with a row of ten troughs at the rear. A sanitary orderly is required. Every morning the tins are washed out with a cresol solution, the floor which should preferably be of a hard nature is swept, and a fire is built in the incinerator. The orderly should cut papers of a proper size to fit the troughs and these are hung on a nail above the troughs. Toilet paper is of course supplied.

OVERCROWDING AND CONTACT INFECTION.

It is a well-recognized fact that overcrowding of a barrack or camp favors the transmission of most diseases, including the inflammations of the respiratory passages, and many diseases become epidemic from this cause.

TUBERCULOSIS.—The extent to which the development of tuberculosis is favored by overcrowding may be seen by a single instance. In 1857 a Royal Commission was instructed to inquire into the conditions of barracks and hospitals in the United Kingdom. It was found that one-quarter of the army lived in rooms affording less than 350 cubic feet per man and only about 6 per cent. enjoyed a per capita allowance of 550 cubic feet. The death-rate for tuberculosis was much higher among soldiers than for the civilian population. The commission recommended that 600 cubic feet should be allowed for each man, an improvement that was gradually carried out, and the death-rate for tuberculosis fell from 2.78 per 1000 to 0.31 per 1000.

PNEUMONIA.—This disease became epidemic both on the Canal Zone and in the mines at the Rand. General Gorgas stated that he was satisfied that the scattering of the negroes was the chief cause of the sudden and permanent drop in pneumonia on the Isthmus.

Measles, mumps, cerebrospinal meningitis, tonsillitis, common colds, and other respiratory diseases are all favored by overcrowding because direct contact infection is greatly facilitated. The same thing is true of typhoid, dysentery, and other intestinal diseases that may be spread by contact. Typhus is also spread by close contact which may permit the infestation of an entire company from a single lousy individual.

Amount of Space to be Allowed Each Man.—Sanitarians have agreed that to afford a proper air space for ventilation without a draught, a minimum of 720 cubic feet per man must be allowed, and that any permanent barracks must be constructed so as to allow at least 1000 cubic feet per man. But for the purpose of avoiding contact infection, the amount of floor space allowed each man is much more important than the number of cubic feet. The floor space should never be less than 10 by 6, or 60 square feet, which with a ceiling 12 feet high would afford 720 cubic feet. Whenever possible the floor space should be 80 square feet, affording 960 cubic feet.

Although military necessity may make such a rule impracticable in the field or in some camps, nothing less than stern military necessity should cause any reduction in this amount of floor space, for the amount proposed as a standard is not a high ideal but an irreducible minimum for the maintenance of health. Should an epidemic occur, and should the soldiers be overcrowded, it may be assumed axiomatically that the epidemic cannot be checked by other sanitary measures alone, but that they must be combined with measures to relieve the overcrowding.

THE TRADE IN SALIVA.—Closely connected with the subject of contact infection is the perpetual trade in saliva. The fingers and various objects are brought in contact with the mouth or nose, and these secretions, often containing some infection, are transferred to other people either directly

or by means of some intermediate object. To prevent this in camp and barracks the following notice may be advantageously posted in conspicuous places.

TO AVOID SPREADING DISEASE.

Do not spit.
Do not put the fingers in the mouth unnecessarily.
Do not pick the nose or wipe it on the hand or sleeve.
Do not put pencils in the mouth.
Do not put anything in the mouth without a good reason, and never when it has been in another's mouth.
Do not use a common drinking cup. Use your own.
Never cough or sneeze into the air or in another person's face.
Use a handkerchief.
If the hands become soiled with saliva or nasal secretion, wash them.
If you use another man's tobacco pouch do not close it with your teeth.

VENTILATION.

General Principles.—All recent work indicates that the effect produced by the air of a badly ventilated room is primarily due to the increase in temperature and humidity, and that these conditions are largely aggravated by any want of movement in the air. Decrease of oxygen or increase of carbon dioxide are not of direct importance. The proportion of oxygen present in even the worst ventilated rooms varies but slightly in amount from that in the air of the open country, while if temperature and humidity are kept at the proper point it is possible to work in a room with a proportion of CO_2 as high as 60 per 10,000. Some of the conclusions of the New York State Commission on Ventilation are as follows:

8. These experiments seem to indicate that overheated

rooms are not only uncomfortable, but produce well-marked effects upon the heat regulating and circulatory systems of the body, and materially reduce the inclination of the occupants to do physical work. The most important effects of bad air are due to its high temperature, and the effects of even a slightly elevated room temperature such as 75° F. are sufficiently clear and important to warrant careful precautions against overheating.

9. The chemical changes in the breathed air of occupied rooms are of a comparatively minor importance, although the substances present in such air may exert a slight decrease in the appetite for food.

But while the quantities of CO_2 in even the worst ventilated room do not account for the effects of bad ventilation, the percentage of this gas is still retained as the simplest and most accurate test of ventilation in inhabitated rooms. It serves as an index of the conditions that are deleterious.

Test for CO_2 method of Cohen and Appleyard, recommended by the laboratory section of the American Public Health Association.

Principle of Method.—Lime-water colored with phenolphthalein if brought in contact with air containing more than enough CO_2 to combine with all the lime will become decolorized by the excess of CO_2, and this is a time reaction.

Application.—Collect samples of air in ½-liter glass-stoppered bottles. Run in 10 c.c. standard lime-water solution and note the time. Shake bottle vigorously until color disappears, and note time and estimate amount of CO_2 from the following table:

Time in minutes.	CO_2 per 10,000.	Time in minutes.	CO_2 per 10,000.
1¼	16.0	3½	6.0
1⅓	13.8	4	5.3
1½	12.8	4¼	5.1
2	12.0	5	4.6
2¼	11.5	5¼	4.4
2¾	8.6	6¼	4.2
3¼	7.7	7½	3.5

Standard Lime-water.—To a liter of distilled water add 2.5 c.c. of phenolphthalein (0.7 gm. phenolphthalein in 50 c.c. alcohol plus 50 c.c. water). Stand bottle on a piece of white paper and add, drop by drop, saturated lime-water until a faint color persists for a full minute. Now add 6.3 c.c. of saturated lime-water and quickly cork the bottle.

Amount of Air Required.—This has always been based on keeping the amount of CO_2 down to the permissible limit of 6 parts per 10,000, *i. e.*, 3 parts as normal constituent of air and 3 parts as the result of contamination. Here, again, it should be remembered that this is merely an index of other conditions that are deleterious.

It is usually calculated that each person should receive per hour 3000 feet of fresh air in a steady, even manner, without draught or perceptible change of temperature. Experience shows that when the amount of air per hour introduced into a room is more than three or four times its cubic capacity a current becomes perceptible. The capacity allowed each man should be at least 750 cubic feet.

Floor Space.—The amount allowed each man should never be less than 60 square feet, and 80 square feet is much better (See note on Overcrowding.) This with a 12-foot ceiling would allow each man 960 cubic feet.

Practical Rule for Ventilating Inlets and Outlets.—A good, practical rule is to give each person no less than 30 square inches; this with a velocity of two feet per second will deliver 1500 cubic feet per hour. This artificial ventilation is never relied on exclusively, but is supplemented by natural ventilation. A better distribution of air is obtained by providing small and numerous inlets rather than few and large.

Inspection for Bad Ventilation.—To determine whether ventilation is satisfactory a medical officer should inspect barracks in the early hours of the morning when the air is at its worst. The carbon dioxide test may be made to obtain accurate records, but for practical purposes this is not neces-

sary. On entering from the fresh outside air the nose is very sensitive to stagnant air and bad odors and is a sufficiently accurate guide for practical work.

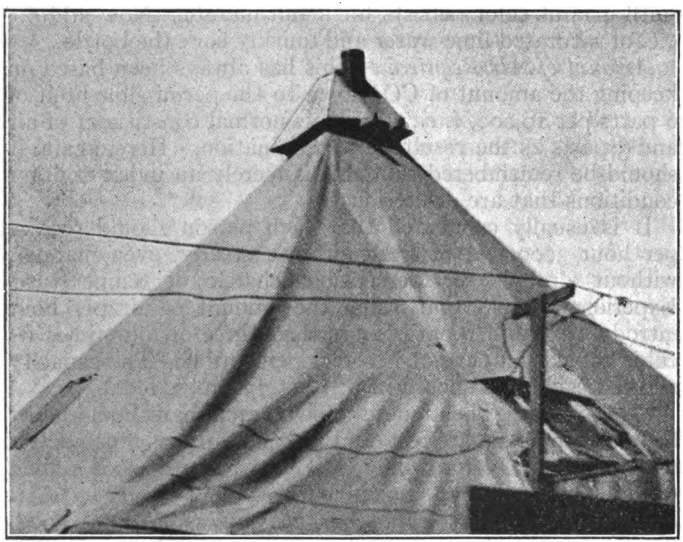

FIG. 6.—Ventilation of tents. (Lewis and Miller.)

Ventilation of Tents.—In cold weather there is a tendency to close all air holes in a tent. On the border last winter when Sibley stoves were installed, a metal hood with a hole through the side to accommodate the stove pipe was substituted for the canvas hood on all pyramidal tents. An order was issued requiring this hood to be raised 4 inches above the canvas. This arrangement gives protection from the rain and at the same time ensures a certain amount of ventilation.

Bathing.—In permanent camps bathing and laundry facili-

ties should be provided, and the sanitary officer should assure himself that these facilities are used and operate satisfactorily.

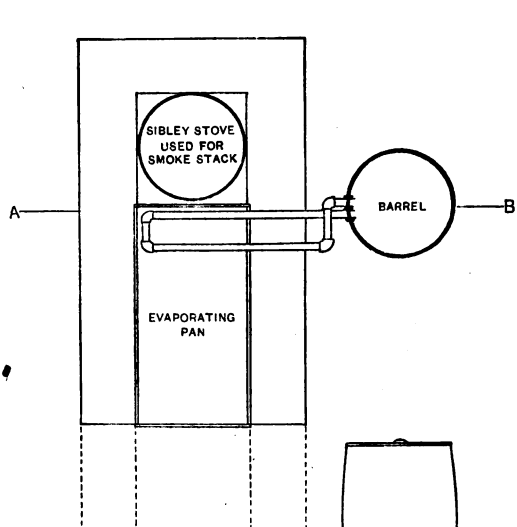

FIG. 7.—Hot-water apparatus. (From Truby, in the Military Surgeon.)

In semipermanent camps care must be taken that the wash water is disposed of in a proper way and that the ground does not become soiled with these wastes. Troughs are often built where the men can place their wash basins, and unless care is exercised these basins will be emptied upon the surrounding ground, which soon becomes muddy and filthy.

Where there are no sewer facilities, as in temporary camps, this waste water can be disposed of in soakage pits. These are simply deep pits that are filled with stones of various sizes, and the top covered with sod except for a small opening several feet square where the waste water is poured. Such pits do not function well in a clay soil.

Hot Water.—Hot water is almost essential, especially for washing greasy dishes and mess kits. In permanent camps provision for hot water will be made, but in semipermanent camps there is often no provision except the company stove which will usually be wanted for other purposes. Whenever camps are sufficiently permanent to build incinerators, advantage may be taken of this apparatus to provide hot water. Thus an iron tank may be built into the incinerator just beyond the smoke stack where the hot gases of combustion must pass. The following device described by Major Truby in the *Military Surgeon* is excellent, and such an apparatus will provide a plentiful supply of hot water for dishes and for a number of baths daily.

One 1¼-inch pipe of galvanized iron leads from the bottom of an ordinary water barrel, through the fire-box of the kitchen incinerator and back again to the barrel. The return pipe enters the barrel about 8 inches above the bottom. The pipes from the barrel pass horizontally through one of the side walls of the incinerator, and across the whole width of the fire-box just beneath the evaporating pan. The barrel may be connected with the supply pipe from the water main if desirable.

Materials Required.—1 piece pipe, 5 feet long; 1 piece pipe, 4½ feet long; 3 pieces pipe, 8 inches long; 4 elbows; 4 lock nuts; 1 tap for drawing off water.

RECREATION.

The subject of recreation is generally ignored in books dealing with practical sanitation, possibly because it is

assumed that recreation will be spontaneous if the soldier is left to his own devices, and that there is no occasion for the sanitary officer to concern himself on this point.

Experience indicates that this view is fallacious. The soldier when left to himself too often lies about in utter boredom or seeks a neighboring town, where he falls a willing victim to "wine, women and song," not so much because of inherent evil tendencies as because of his utter inability to amuse himself in more legitimate ways.

It is ordinarily considered that the provision of recreation is a function of the chaplain, and when a chaplain of the right type is present, this matter may be safely left in his hands, although he should receive the cordial support of medical officers in his efforts. When a chaplain is not present, medical officers should consider this work as a part of their sanitary duties, for it is one of the immutable laws of human nature that certain periods of recreation are necessary if good work is to be performed. And if the recreation is provided, the men will not only perform their duties with greater zest, but in many cases will be saved from drunkenness and venereal disease when all the preachments of the chaplain, the lectures of the sanitary officer and the orders of the commanding officer fail.

In a permanent camp there should be a library for all who enjoy reading, and moving pictures should be shown frequently. Interest in games, both athletic and otherwise, should be stimulated, and every effort should be made to provide the men with legitimate occupation.

When soldiers are on active duty at the front their minds are fully occupied too often by no pleasing sights and sounds. When they return to the rear for a period of recuperation it is especially important that recreation of an active kind be provided to prevent an idle mind from brooding upon past experiences. This is a fertile cause of neurasthenia and mental strain. Lelean, in *Sanitation in War*, says: "The tension

of actual danger serves as a stimulus which carries men with credit through the experiences in the trench itself. The inevitable mental reaction is proportionate to the temporary exaltation, and return to billets is followed by depression of which only the highly strung man knows the full intensity. In the enforced inaction of the forty-eight hours rest before duty again calls his unit to the trenches, scenes of horror which were only subconsciously perceived during the stress of action emerge with vivid persistence, and the unceasing boom of the enemy's guns keeps memory perpetually alert. As the hours of respite from the imminence of violent death slip by, men who recall their own hair-breadth escapes and note the empty places of many a comrade can but speculate involuntarily upon the odds against their own escape from dangers constantly renewed. The higher moral courage carries them through the effort of dissimulation, but the effort is a costly one in mental strain. To what practical conclusion does this consideration lead? That every effort must be made to provide our men with occupation which will fill this period of suspense so full of other interests that there will be no leisure for brooding or anticipation, while relaxation of all tension gives the opportunity for recuperative mental rest."

It should be noted in this connection that the Army Young Men's Christian Association has been accorded an official status by Circular 15, 1904, W. D., and G. O. 39, 1914. These orders provide that suitable sites will be selected and assigned for the tents of the association, and that the equipment of the association will be transported when means are available.

PHYSICAL TRAINING.

The recruit is generally an untrained man and is usually incapable of sustaining the strain of marching with his equipment. While in camp he must therefore be trained to march and also to use the arms with which he is provided. Although

this training is necessarily executed by line officers, the medical officer should be familiar with the principles of physical training, and should be on guard to see that the men are not injured by being required to perform exercises beyond their limit of endurance. Undue fatigue does not strengthen but weakens, and may result in serious injury, particularly to the heart.

The objects to be accomplished by physical training are:

1. The loss of excess fat and the hardening and strengthening of the muscles.

2. *Coördination.*—The muscles and nervous system of the untrained man are incoördinated, and as a result he expends far more energy than the trained man in performing the same amount of work. The trained swimmer slips through the water much more easily than the novice by the expenditure of a trifle of the energy dissipated by the latter. The same principle applies equally to marching. Marching is not the same thing as walking. In addition to carrying a load, the marching soldier must walk at a prescribed gait which is often not his customary gait. This brings entirely new sets of muscles into action, and training is therefore required for efficient marching quite as much as for efficient swimming.

3. *The Training of the Heart Muscle.*—When the untrained man exerts himself the heart is too weak to maintain the increased blood flow required, and as the blood-pressure is increased by exercise, there is a tendency for the heart to become distended. If exertion is too severe this may cause actual dilatation. With training the heart, like the other muscles, becomes competent to perform the increased work.

4. Training the respiratory system to eliminate rapidly the waste products which result from muscular action, and which produce shortness of breath and fatigue when they accumulate.

EXERCISES.—All exercises tend to accomplish the objects enumerated under the first, third and fourth headings, but

coördination can only be secured by training in the particular exercise in which skill is required. Marching will not perfect a man in bayonet drill and *vice versa*. Therefore the only way to train a man to march is to march. All exercises should be carefully graduated so as to avoid undue fatigue at any time, and should be made as varied and interesting as possible. Light exercises frequently repeated are of much more value than heavy, continuous exercise. The time devoted to exercise should not exceed five hours daily—three in the morning and two in the afternoon—and no exercises should be held immediately following a meal. In accordance with these principles marches should at first be easy and without packs. The length of the march should be progressively increased, and when sufficiently trained and hardened the men should march with the full pack. Before marching particular attention should be paid to the fitting of soldiers' shoes and socks, and they should be instructed in the care of the feet. See G. O. No. 26, W. D., 1912. (This order is included under notes on the March.)

Danger Signs.—Any sign of enlargement of the heart, a weak or irregular pulse, or a pulse that does not return to normal within an hour after exercise, indicates that the particular exercise was too severe. Constant lassitude, impaired appetite and digestion and loss of weight and strength indicate that the exercises are being overdone and that the men are becoming overtrained.

SOLDIER'S HEART.—This term has been used to describe the various functional cardiac disorders especially common among soldiers both during the period of training and particularly while on active service. It is most commonly due to the effect of overexertion which may be associated with mental strain and insufficient sleep or with some form of toxemia, more particularly the excessive use of tobacco.

Symptoms.—Very moderate exercise which should not hurt anyone produces shortness of breath, giddiness, faintness and

exhaustion. More violent exercise produces dyspnea and palpitation. Discomfort or pain in the region of the heart, with palpitation, tachycardia and neurasthenic condition are generally present. If a diagnosis of valvular disease be made, this increases the neurasthenia. The pulse may be normal at rest but the slightest exertion accelerates it.

The blood-pressure is normal or low. There is usually some dilatation on both sides of the heart, but especially on the right side. Murmurs may be present and may lead to a diagnosis of valvular disease, but these murmurs are always systolic and tend to disappear as the condition improves, while there is no history of rheumatism or endocarditis or other condition that would cause valvular trouble.

Treatment.—Assure the patient that he will recover to relieve his mind and prevent neurasthenia from developing. Compel rest in bed until the dilatation is entirely gone. Thereafter the patient must take graduated exercises just insufficient to cause exhaustion, dyspnea, or pain. The man should not be sent to duty until he can do a full day's work, which may require from three weeks to a year's treatment, depending on the severity of the condition. Most cases can be returned to duty if carefully managed, but a few, especially those of generally poor physique, will probably have to be discharged on a certificate of disability.

Prophylaxis.—The avoidance of undue strains by untrained men: It would seem almost axiomatic that all men should not be subjected to exactly the same exercises. Those exercises that can be performed with ease by a man accustomed to manual labor or athletic exercises may prove exhausting to the student or clerk who has been polishing a chair for several years. Common-sense therefore indicates that in training a large number of men from all walks of life, these men should be divided into classes so that excercises may be suited to their various abilities. The determination of the class to which a man should belong would naturally be made

by the surgeon, and in examining a man for this purpose, Pignet's index, taken in conjunction with muscular development and past occupation, should afford a good guide.

PIGNET'S FORMULA FOR ESTIMATING PHYSICAL EFFICIENCY.—The weight in kilograms and the chest measure at expiration in centimeters are added and subtracted from the height in centimeters.

Index of Efficiency.—

Under 10	Very strong
From 10 to 15	Strong
15 to 20	Good
20 to 25	Fair
25 to 30	Weak
30 to 35	Very weak
Above 35	Useless

In order to use this formula which has been very widely applied in calculating physical efficiency, it is necessary to translate our inches and pounds into the metric system. Inches divided by 0.3937 equals centimeters. Pounds divided by 2.2046 equals kilograms.

Examples.—A man 5 feet 8 inches in height (172.7 cm.), 36 inches chest (91.4 cm.), and 152 pounds (69 kilo). 69 plus 91.4 from 172.7 equals 12.3 or strong.

A man 5 feet 10 inches in height (177.8 cm.), 34 inches chest (86.3 cm.), and 140 pounds weight (63.6 kilos). 63.6 plus 86.3 from 177.8 equals 27.9 or weak.

VENEREAL PROPHYLAXIS

G. O. No. 17, W. D., Washington, May 31, 1912. 1. It is enjoined upon all officers serving with troops to do their utmost to encourage healthful exercises and physical recreation and to supply opportunities for cleanly social and interesting mental occupations for the men under their command; to take advantage of favorable opportunities to point

out, particularly to the younger men, the inevitable misery and disaster which follow upon intemperance and moral uncleanliness, and that venereal disease, which is almost sure to follow licentious living, is never a trivial affair. Although the chief obligation and responsibility for the instruction of soldiers in these matters rests upon company officers, the medical officers should coöperate by occasional lectures or other instruction upon the subject of sexual physiology and hygiene and the dangers of venereal infection.

2. Commanding officers will require that men who expose themselves to the danger of contracting venereal disease shall at once upon their return to camp or garrison report to the hospital or dispensary for the application of such cleansing and prophylaxis as may be prescribed by the Surgeon-General. Any soldier who fails to comply with such instructions, if found to be suffering from a venereal affection, shall be brought to trial by court-martial for neglect of duty.

3. Commanding officers will require a medical officer, accompanied by the company or detachment commander, to make a thorough physical inspection twice in each month of all the enlisted men (except married men of good character) of each organization belonging to or attached to the command. These inspections will be made at times not known beforehand to the men and preferably immediately after a formation. The dates on which the physical inspections of the various organizations are made will be noted on the monthly sanitary reports.

At these inspections a careful examination of the feet and footwear and of the condition of personal cleanliness of the men will be made, as well as careful observation for the detection of venereal diseases.

Cases of the latter will be promptly subjected to treatment, but not necessarily excused from duty unless, in the opinion of the surgeon, deemed desirable. They will be made of record in the medical reports in any case. A list of those

diseased but doing duty will be kept both by the company or detachment commander and the surgeon, and the infected men will be required to report to a medical officer for systematic treatment until cured. While in the infectious stages the men should be confined strictly to the limits of the post. When a venereal case, whether or not on sick report, is transferred to another command, the surgeon will send a transfer slip giving a brief history of the case.

4. All instructions from the War Department prohibiting the publication in printed or other orders of instructions prescribing examinations having in view the detection of venereal diseases among enlisted men, heretofore issued, are recalled. [1915426, A. G. O.]

By order of the Secretary of War:

LEONARD WOOD,
Major-General, Chief of Staff.

Official:

W. P. HALL,
Adjutant-General.

Confidential Circular to Medical Officers: W. D., Office of the Surgeon-General, Washington, June, 1912. The following directions for carrying out the system of venereal prophylaxis directed by par. 2, G. O. 17, W. D., 1912, are published for the information and guidance of medical officers:

A suitable, easily accessible room in the hospital (or dispensary) at each post will be selected for this purpose, which should be provided with a good light and such medical supplies, basins, and other equipment as may be necessary. A competent, properly instructed man of the Hospital Corps, or more when necessary, will be or duty there between retreat and reveille, and will be within call at other hours.

The procedure in the case of men reporting for treatment will be as follows:

1. The name, rank, and organization of the soldier, with the day and hour of treatment should be entered for record

on a card furnished for the purpose, which will afterward be examined and authenticated by the initials of a medical officer. These records should be regarded as confidential and should be kept in a secure place and not shown to unauthorized persons or except upon proper authority. They will not be preserved longer than three months.

2. The genital organs will be thoroughly washed with soap and warm water.

3. An injection will be made into the urethra of 4 c.c. of the standard solution of 2 per cent. protargol dissolved in glycerin 15 parts, water 85 parts. This should be retained in the urethra for three minutes. In individual cases when the protargol solution is found to produce an irritating effect, a 20 per cent. solution of argyrol may be used. Other solutions or modifications of these solutions will not be used for routine administration.

4. The entire penis will be rubbed with calomel ointment (30 per cent. in benzoated lard), care being taken that the folds of the prepuce and about the frenum are thoroughly covered. If any pimples or abrasions exist about the scrotum or the pubic region, these should also receive an application of the ointment.

The parts should be then wrapped in a napkin of soft paper furnished for the purpose, in order to protect the clothing.

A record of each prophylactic treatment should be kept on the Venereal Prophylaxis card, form 77, M. M. D.

THE MARCH.

THE general principles concerning the conduct of marches are given in paragraphs 96–114 F. S. R., 1914, with which all medical officers should be familiar.

It is advisable to begin the march slowly until the body is warmed to the point at which muscular action is most efficient. This will generally be accomplished after marching about a mile. It is also well to slow the pace at the end of the march in order to avoid going into camp while heated and perspiring. In hot weather the shirt should be open to permit free evaporation of perspiration, and the column should be kept as open as possible in order to afford each man plenty of air and access to the cooling breeze. Halts should preferably be made on dry ground sheltered from the sun in summer and from the wind in winter, and should not be long enough to permit the muscles to become stiff.

WEIGHT TO BE CARRIED.—The maximum that a soldier can carry without serious loss of efficiency is 30 per cent. of his body weight. A man of 150 pounds can therefore carry 45 pounds. With the present pack, the weight of the full equipment is 40 pounds 5 ounces; of the marching equipment, 31 pounds 4 ounces, and of the fighting equipment 39 pounds 1 ounce. When transportation is available, part of the equipment should be carried on the wagons.

FIT OF SHOES AND CARE OF FEET.—The ability of a man to march depends very largely upon the condition of his feet, and when the feet are disabled it is usually because of badly fitting socks or shoes. The following order, if strictly complied with, will eliminate most foot troubles.

G. O. No. 26, W. D., Washington, August 16, 1912. With a view to increasing the marching capacity of troops, company commanders will personally measure the feet and fit the shoes of men of their commands and will be held responsible that the instructions herein contained are strictly followed.

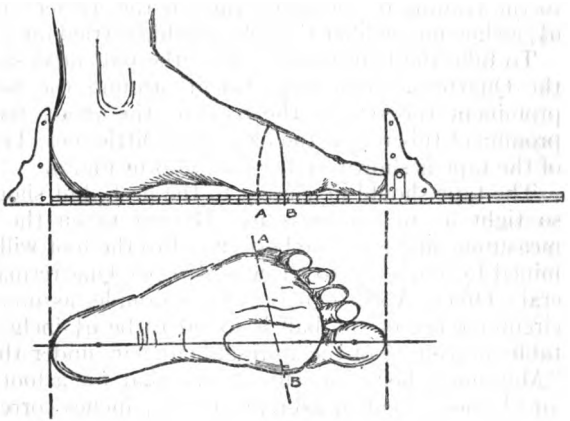

FIG. 8.—Showing how to take measurements for the fitting of shoes. (War Department.)

All measurements prescribed herein will be taken with the soldier standing in bare feet and with a 40-pound burden on his back, bearing the entire weight upon the foot to be measured. Balance may be preserved by resting the hand on a fixed object. The measurements of the foot, which must be taken to make suitable preliminary selection of the shoe to try on, are (*a*) the length, (*b*) the circumference around the ball.

To measure the length the soldier will stand with foot upon the foot measure, furnished by the Quartermaster's

Department, fitted in a slot in a board, the heel of the soldier fitting snugly against the heel block. The movable block will then be pushed up until it touches the end of the great toe. The scale on the top of the measure, which is graduated in sizes, will then be read, and the proper length of the shoe will be determined, approximately, by adding 2 to the reading of the scale; thus, if the soldier's foot scales $6\frac{1}{2}$, a shoe not smaller than $8\frac{1}{2}$ should be tried on first.

To take the ball measure, pass the foot tape, supplied by the Quartermaster's Department, around the foot at the prominent tubercle at the base of the great toe and the prominent tubercle at the base of the little toe. The position of the tape is shown by the line *A–B* in Fig. 9.

The tape should lie closely to the flesh, but should not be so tight as to compress it. Having taken the foregoing measurements, the shoe best suited to the foot will be determined by reference to Circular No. 10, Quartermaster General's Office, April 6, 1912. For example, assume that the circumference of the ball is found to be $9\frac{1}{4}$ inches. In the table on page 28 of the aforesaid circular, under the heading "Marching Shoes," it will be seen that for a foot requiring an $8\frac{1}{2}$ shoe a ball measurement of $9\frac{1}{4}$ inches corresponds to a D width. The size of shoe to try on for actual fitting is, then, in this case, $8\frac{1}{2}$ D.

If the ball measurement found as above does not correspond exactly with any ball measurement given in the table, then the narrower of the two widths between which the measurement lies should be selected.

Beginning with the size and width thus tentatively selected, shoes will be tried on until a satisfactory fit is secured. Correct fit in waist and instep will be determined experimentally. To determine the fact of fit the shoe will be laced snugly and the soldier with a 40-pound burden upon his back will again throw his entire weight on one foot. The officer will then press in the leather of the shoe in front of

the toes to determine the existence of sufficient vacant space in that region to prevent toe injury. Under no circumstances should this vacant space in front of the great toe be less than two-thirds inch; nor should there be pressure on the top of the toes. The officer will then grasp with his hand the leather of the shoe over the ball. As his fingers and thumb are brought slowly together over the leather, the shoe should feel snugly filled without apparent tension, while the leather should lie smoothly under the hand. If the leather wrinkles under the grasp of the hand, the shoe is too wide and a narrower width is needed; if the leather seems tense and bulging and the hand tends to slip over easily, the shoe is too narrow and a greater width is necessary.

It may be necessary to try on several pairs of shoes in this manner before an entirely satisfactory shoe is secured. A record of the proper size and width of shoes as determined above will be kept as provided in Circular No. 10, Quartermaster General's Office, April 6, 1912.

Measurements will be taken and shoes will be fitted as prescribed at least once in each enlistment and the record will be changed from time to time if subsequent fittings render a change necessary.

Sizes called for in requisitions will conform to the record and the fact of fit of shoes issued on such requisitions will be personally verified in every instance by company commanders in the manner above prescribed.

No shoes will be issued to, or worn by, enlisted men while on duty which are not fitted in accordance with this order.

New shoes should be adapted to the contours of the feet as soon as possible. Shoe stretchers, with adjustable knobs, to take pressure off painful corns and bunions, are issued by the Quartermaster's Department.

All shoes should be properly broken in before beginning a

march, but if this is impracticable, then the following is suggested but not required:

The soldier stands in his new shoes in about 2½ inches of water for about five minutes until the leather is thoroughly pliable and moist; he should then walk for about an hour on a level surface, letting the shoes dry on his feet, to the irregularities of which the leather is thus molded in the same way as it was previously molded over the shoe last. On taking the shoes off a very little neat's foot oil should be rubbed into the leather to prevent its hardening and cracking.

If it is desired to water-proof the shoes at any time, a considerable amount of neat's foot oil should be rubbed into the leather.

Light woolen or heavy woolen socks will habitually be worn for marching; the socks will be large enough to permit free movement of the toes, but not so loose as to permit of wrinkling. Darned socks, or socks with holes, will not be worn in marching.

Company commanders, by frequent inspections throughout the year, will maintain the feet of their men in condition for proper marching. They will cause the proper trimming of nails, removal or paring of corns and callouses, relief of painful bunions, treatment of ingrowing nails, and other defects, sending serious cases to the surgeon.

Before a march is undertaken by foot troops company commanders will personally inspect the bare feet of their men. While on the march they will personally see each day that their men wash their feet as soon as possible after reaching camp, prick and evacuate blisters, and cover such blisters or excoriations with zinc oxide plaster, supplied by the Medical Department, applied hot, dust the feet with the foot powder supplied by the Medical Department, and put on clean socks. Hereafter an undue amount of foot injury and disability from shoes will be regarded as evidence

of inefficiency on the part of the officers concerned and as causes for investigation.

Post quartermasters will provide a place in the quartermaster's storehouse where shoes may be fitted for the purpose of determining or verifying the record required by G. O. No. 48, W. D., 1911. For the purpose of fitting they will keep on hand at all times a complete series of each size and width of shoes furnished for issue. Shoes of this series will be put in stock and issued before they become unserviceable, and will be replaced by new shoes, keeping the series always complete. Company commanders will report in writing to the post commander every instance of failure to secure proper shoes for their commands or to obtain proper facilities for fitting the shoes as herein directed. Post commanders will investigate the reasons for and be held responsible as far as lies in their power for the rectification of such deficiencies.

A brief record of the number of such reports from company commanders and the reason for such deficiencies will be furnished to inspectors at each inspection of the post.

Inspections conducted under the provisions of paragraph 913, Army Regulations, will embrace an inquiry into the manner in which this order has been complied with, and the report of inspections will include a statement of all instances of failure on the part of company commanders to secure proper shoes for their commands and the cause of such failure.

[1856626 S—A. G. O.]

By order of the Secretary of War:

LEONARD WOOD,
Major-General, Chief of Staff.

Official:

GEO. ANDREWS,
Adjutant-General.

WATER SUPPLY ON THE MARCH.—The amount of water required by a man depends upon certain physiological principles.

1. The exercise of marching, like all general muscular exercise, produces an elevation of the body temperature of from 2 to 3° F.—that is, to between 100.4° and 101.4° F.

2. This rise is physiological, beneficial, and in fact necessary to the efficient performance of muscular work.

3. This elevated temperature is the normal for the condition of active exercise, just as 98.4° is the normal for rest.

4. The temperature is kept at this constant level by three methods of heat loss, radiation, convection, and evaporation of perspiration.

5. The marching soldier is chiefly dependent on evaporation of perspiration for the regulation of bodily temperature, especially on warm days, when the surrounding air is not much if any cooler than the body.

6. The body contains a considerable amount of water and cannot lose more than a certain amount without loss of efficiency. Therefore the regulation of the temperature by evaporation necessitates a replacement of the water lost.

The question of water supply on the march therefore resolves itself into two questions, namely, How much water can the body afford to lose, and when and how often must this water be replaced?

How much water can the body afford to lose? A man weighing 150 pounds contains in his tissues 100 pounds of water. He cannot afford to lose more than one-tenth of this, that is, 10 pounds or 1 gallon, without endangering his life. If a man is in good condition and well trained, he can perhaps afford to lose 7.5 pounds, or 6 pints, without loss of efficiency or great suffering; while if in bad training, a loss of 2 pints will impair efficiency and cause discomfort. These quantities represent the upper and lower limits of permissible loss. But whether the limit of permissible loss be high

or low it must be emphasized that once this limit has been reached the lost water must be steadily replaced. From this time on all water lost through evaporation must be replaced to avoid loss of efficiency, suffering, or even death.

How much water will a man lose in marching a given distance? The actual exertion demanded by a march of one mile over undulating country may be estimated as 90 gram calories for a soldier with full equipment. If the heat thus produced is to be dissipated by evaporation, then for every mile 180 c.c. of water must be evaporated. In one hour's march, covering three miles and allowing a ten-minute halt in the hour, the soldier will have lost 540 c.c. or almost a pint (570 c.c.). But for the first mile the heat produced will be utilized in raising his bodily temperature to the optimum for exercise, and heat regulation will not come into play until this distance has been covered. We may estimate therefore that at the end of the first four miles he will have lost 1 pint, at the end of seven miles nearly 2 pints, the amount fixed as the lower limit of possible loss. In the case of the untrained man we may therefore assume that he should be able to march seven miles, or half an ordinary day's march without drinking. At the half-way halt he must have his first drink, and after that 1 pint of water regularly every hour during the march. The canteen contains about 1 quart, of which 1 pint may be taken after covering seven miles at the half-way halt and the remainder at the end of ten miles, after which he should be able to cover the remainder of the fourteen miles and get home without any further supply. However, if the road be a hard one, hilly, muddy, or the day unusually warm, this estimate will not hold and more water must be supplied. If the march be continued beyond ordinary limits, as in a forced march, then every man must have his pint of water every hour after the limit of endurance is reached. It is on the recognition of this fact that the efficient performance of forced marches depends.

We may conclude therefore:

1. A soldier on the march, even if untrained, should be able to cover the first half of the march, that is seven miles, without a drink.

2. That at the half-way halt of an ordinary march he should be allowed to drink half the contents of his water bottle and the remainder at the next hourly halt.

3. If a march is over fourteen miles with raw troops or over twenty with any, the staff should make careful plans for the watering of the men at the rate of 1 pint per man per hour, or per three miles, as long as the march lasts. The necessity of replacing the water regularly hour by hour may be emphasized. A double allowance at longer intervals does not answer the purpose so well, although of course it might be unavoidable. Water after ingestion is only slowly taken up by the tissues, and if there is any excess it merely passes through the kidneys without doing the body much good so far as heat regulation is concerned. Water supply must be regular and sufficient, and must never be left to chance any more than the supply of ammunition may be left to chance.

Officers who can get along with less water than this should remember that they rarely carry the same weight as the men, and therefore not only perform less work in marching the same distance, but also that they are able to regulate the heat much better because evaporation from the skin is not impeded by the equipment, and because they do not march in the ranks where the air is close, but on the outskirts where they catch all the breeze.

The quality of the water obtained is a most important thing, and every effort must be made to secure water of the proper quality for the men. But is must be remembered that a certain quantity is absolutely indispensable if life is to be maintained, and that the appetite for water, after the body has become depleted to the limit of permissible loss, is a most

imperious demand. We may as well expect a starving dog to abstain from a piece of meat as to expect the marching soldier to abstain from water under these circumstances. The only way to prevent soldiers from drinking water from improper sources is to see that he is supplied with a sufficient quantity from a pure source.[1]

To Estimate the Amount of Water Delivered by Streams.—The sectional area may be estimated by the average depth. The velocity may be estimated as four-fifths of the surface velocity, as shown by the time it takes a stick to pass a known distance. The number of cubic feet passing a certain sectional area in a given time is thus ascertained. This may be converted into gallons by multiplying by the factor 6.23.

Hot Water for Marching Commands.—When men are on the march for more than a day at a time their mess kits become filthy unless some provision is made for washing them. Often the soldier will simply scrub them out with grass or dead leaves. Grease can only be removed by washing with hot water. The sanitary officer should therefore see that it is provided and used. As soon as the meal is cooked, water should be placed on the stove by the cook, and the knives, spoons, and meat cans can be washed in this. Each man washes his own, and as men do not finish eating all at once, the washing need cause little delay. If possible the water may be heated much hotter by placing it on the fire while the meal is in preparation.

THE PURIFICATION OF WATER IN THE FIELD.—Unless the water supply has been pronounced safe by the sanitary officer it must be purified before use. The following methods are recommended in the order given:

The Lyster Water-bag.—An appliance carried on the supply table as water-bag, field sterilizing, and is an adaptation of the principle of sterilization by chlorin, to the needs of

[1] This note is largely an abstract of an article by Col. C. H. Melville, R. A. M. C. Water Supply on the March.

troops in the field. It consists of a canvas bag, 20 inches in diameter and 28 inches in length, sewn to a flat galvanized iron ring which is hinged so that it folds. Spliced at four equidistant points on the ring are two crossed pieces of hemp rope, enabling the bag to be suspended on any convenient support capable of holding the weight of the bag when filled with water, which is about 330 pounds. Five nickel, spring faucets are placed at equal spaces about the bottom edge of the bag. The neck of these faucets is small enough to enter a canteen, which can be filled in ten seconds. The self-closing faucets prevent wastage. The bag provides a receptacle in which water can be held long enough to sterilize it and then distribute it. After the bag is suspended and filled with water (30 gallons) it is sterilized by the addition of calcium hypochlorite. This is carried in measured doses sealed in glass tubes. A package of sixty of these tubes weighs 10 ounces and measures $7\frac{1}{2}$ by $3\frac{1}{2}$ by $4\frac{1}{4}$ inches. Packed in corrugated paper it will stand rough usage. The tubes themselves are 3 inches in length by $\frac{3}{5}$ of an inch in diameter and are marked with a file, enabling them to be easily broken in the fingers without fragments. They contain from 14 to 15 grains of calcium hypochlorite. This chemical contains from 30 to 32 per cent. of chlorin, which forms hypochlorous acid in the water, thus sterilizing it. In the strength used even waters that are highly infected are rendered safe, and all ordinary waters will be entirely safe after this treatment. Experiments have indicated that the organisms causing typhoid and dysentery are destroyed by this treatment after fifteen minutes. In the field after the water has been treated it should be allowed to remain in the bag for from fifteen to thirty minutes, when it may be drawn and used. This treatment will not remove suspended matters. In order to remove these a filter cloth to be fastened over the opening of the bag, and weighing 1 ounce is provided, or the water may be strained through a blanket. One bag will supply sufficient pure water for a company.

A Method of Titration to Determine the Amount of Chlorin Actually Needed for Sterilization of Water.—It is possible that even in hermetically sealed tubes the calcium hypochlorite may undergo decomposition with a loss of the available chlorin. Moreover, the amount used (1 part to 500,000 parts of water) is ordinarily excessive, since it has been found that 1 part of chlorin to 7,000,000 parts of water will kill all bacteria providing the water is free of organic matter. On the other hand, it is possible, though not probable, that if the water contained a great excess of organic matter the amount of chlorin furnished in one of the tubes might be insufficient to sterilize the water. For all of these reasons it is desirable to titrate the water to be treated in order to determine the amount of chlorin that will be required. A simple method for this purpose was described by Professor G. Sims Woodhead in the *British Medical Journal*, September 19, 1914, xi, 494, and this method is being used at present by the British troops in France. The following method is the same as that described by Professor Woodhead, except that it has been adapted to our own service utensils:

1. Rinse a regular ordnance cup (supplied with each canteen and holding 1 pint or 500 c.c.) with water, leaving a few drops of water in the cup. Break one of the tubes of calcium hypochlorite into the cup and mix it into a paste with the few drops of water. As soon as the powder is thoroughly moistened, fill the cup with water to within one inch of the top (500 c.c.) and mix well by pouring into another cup and then back. Part of this solution is used in titrating the water to be sterilized and the remainder is used for sterilizing the water. This solution contains 0.3 gram of available chlorin.

2. Rinse four ordnance cups with the water to be tested and fill all four cups to one inch from the top with the water to be tested. With a pipette (a hypodermic syringe may be used) add 2 c.c. of the calcium hypochlorite solution to the first

cup of water; add 0.4 c.c. to the second cup; add 0.6 c.c. to the third cup; add 0.8 c.c. to the fourth cup. Mix the solution with the water in each cup by pouring it back and forth into another cup and allow the cups to stand for thirty minutes (fifteen minutes if time is important).

3. Into a clean cup crumble a potassium iodide tablet or drop a few crystals of potassium iodide, and add a tablet of soluble starch or a little starch solution made by boiling cornstarch in water for a few minutes. Pour into this cup the water to which was added 0.8 c.c. of the calcium hypochlorite solution (cup 4) and mix by pouring back and forth. If a blue color appears it is an indication that the chlorin has not been all used up in that mixture. It should be pointed out that this blue color is not permanent and disappears in a few minutes. In the same way mix potassium iodide and soluble starch with the samples of cups 3, 2 and 1. The cup that contains the smallest amount of the hypochlorite solution capable of giving a blue color with the potassium iodide and starch contains the proportion of chlorin necessary to sterilize the water being tested. Thus suppose the cup of water to which 0.4 c.c. of the hypochlorite solution was added gives a blue color with the potassium iodide and starch and the sample to which 0.2 c.c. of the solution was added gives no color. The sample to which 0.4 c.c. of the hypochlorite solution was added contains the right amount of chlorin to sterilize the water being tested.

There are 36 gallons, or 288 pints, in the water-bag. Since 0.4 c.c. of the hypochlorite solution was sufficient to sterilize one pint, 115 c.c. of the same solution will be sufficient to sterilize the 288 points in the Lyster bag. The pint of hypochlorite solution already prepared would therefore be capable of sterilizing more than three bags of water. In practice, however, it is believed to be safer to use twice the amount indicated by the titration, so that in the example quoted 230 c.c. of the hypochlorite solution would actually be added

to the water to be treated, or half of the solution (250 c.c.) could be added to the water in one bag and the solution prepared from the tube of calcium hypochlorite would be sufficient to sterilize two bags of water.

While the adoption of this method will cause a little trouble, it is believed that the results obtained will be satisfactory, since the great excess of chlorin at present being used will be reduced and the water thereby rendered more palatable. The method is being used at the front by the British service, which is supplied with tablets of potassium iodide and soluble starch prepared by Parke, Davis & Co.

The Darnall Filter.—Should the Lyster bag not be available this apparatus may be used. This is an adaptation of the principle of mechanical filtration to the needs of troops in the field. It consists of a galvanized iron tank, two water cans, and a siphon filter and cloth crated. The essential part is the cylindrical metal framework of the siphon, over which is wrapped the filtering material, a closely woven cotton fabric. This is placed in the tank filled with raw water to which the precipitant has already been added, and the water after passing through the filtering cloth into the cylinder is discharged by siphonage into the water can. As matters in suspension deposit upon the cloth the flow diminishes, and the filter should be taken out and the cloth removed and cleaned by washing and sterilized by boiling water. The precipitant consists of alum and sodium carbonate in such proportions that they neutralize each other. This precipitant is furnished in a small tin can with a measure which holds 2 grams. The water cans when filled to the mark hold 3 gallons. One measure of the precipitant added to each can of raw water is sufficient for even grossly polluted waters.

The crated filter weighs 52 pounds and will deliver about 200 gallons of water in four hours. It completely clarifies the water, and its bacterial efficiency is about 98 per cent.

This apparatus cannot be depended upon for the certain elimination of all pathogenic bacteria, but it purifies ordinary waters to a degree that renders them reasonably safe. It will furnish plenty of clear water unchanged in temperature and taste within an hour after getting into camp. One filter may be carried by each company in the field.

Boiled Water.—Should neither of these appliances be at hand an impure water should be boiled. A quartermaster G. I. can is filled with water which is left on the fire until it boils. The water is then cooled and used. Soldiers do not like boiled water because of its flat taste, and should this method be used it must be closely supervised by medical officers to be sure the water is actually boiled, and that this is used rather than the raw water. Boiled water is absolutely safe, as none of the pathogenic organisms causing the various intestinal diseases can stand boiling temperature. The objections to its use are that it is troublesome, requires a long time after reaching camp before the water is ready for use, requires fuel which is sometimes unavailable, and the great dislike of the men for the use of boiled water, which renders it certain that some of them will drink the water raw.

LATRINES.—*Latrines for Moving Commands.*—Colonel Harvard's knock-down box consists of eight pieces which are standardized and interchangeable with those of any other box, and weighs 175 pounds. It is put together without screws or bolts, and can easily be taken apart and packed in a wagon when there is plenty of transportation. If it is possible to carry it this box is very convenient and far more sanitary than the open pit generally used with marching commands.

Jones's Improvised Incinerator.—Major Percy Jones has described an incinerator that can be improvised anywhere. A pit is dug, preferably in a hillside, $2\frac{1}{2}$ feet deep, 2 feet wide, and $4\frac{1}{2}$ feet long, with back and floor of brick or stone with or without mortar. If the camp is only for a day or two the stone is unnecessary. One foot below the top the sides have

projecting shoulders upon which are placed two of the McCall excreta pans or an improvised substitute; if used only for one night, wooden pans may be used, which are burned with the excreta. A good fire is built under this once daily and all excreta are consumed. Urine cans may be emptied intermittently on the heated stones. This pit should be covered over with a temporary boxed seat or the Havard box, in order to keep out the flies. Place to leeward of the camp as it produces an unpleasant odor when fired.

Straddle Trenches.—In the absence of any special device or of fuel for incineration, straddle trenches are often used by marching commands. Such trenches may be made 3 feet long, 1 foot wide, and 2 feet deep, each trench being intended to be used by one man at a time. The dirt is heaped up at the end, not at the side, and there should be an interval of 3 feet between trenches. Five trenches are provided for each 100 men, or three or four for each 100 in large commands. A scoop should be provided and a notice posted requiring each man to cover his excreta with earth, and if necessary a sentry may be posted to see that this order is carried out.

Major Patterson has described a straddle trench cover that will practically do for these trenches what is accomplished by the latrine box for semipermanent camps. Two planks, 8 inches wide and 6 feet 8 inches long, are nailed 10 inches apart on four cross-pieces of 2 by 4. The space between these is closed in the middle, but forms an opening 2 feet long on each end for defecation. A hinged cover is provided for each opening which falls of its own weight and keeps the pit covered at all times except when in use. This device being light can easily be carried by marching commands.

TRENCHES AND THE BATTLEFIELD.

SANITATION OF TRENCHES.

THE average trench is 7 feet deep by 1 meter wide, and the sides are lined with wooden uprights braced by cross-pieces.

Trench life is very monotous and trying. On the Western front the men occupied trenches for from three to four days in all weather, and were then relieved for a period of recuperation.

LATRINES.—Latrines should be situated in dugouts a short distance to the rear of the trench, and connected with the latter by a few meters of the connecting trench. The dugout should be deep enough to protect against any missiles except high explosive shells. Here a pit is dug and covered with a latrine seat. Incineration is impossible for lack of fuel, and because it would give the range to artillery. The method adopted has been to collect excreta in small buckets, empty gasoline tins and similar receptacles. These are tightly covered and carried to the rear by the troops when relieved, and clean cans are brought forward and put in place by the new troops. The cans containing the excreta are preferably burned in an incinerator at the rear when fuel is available, but when this cannot be done the cans are buried in deep pits and well covered. Lime or iron sulphate or crude oil may be used to cover the excreta. Iron sulphate is a good deodorant. As the dugout is lighted only by a candle or lantern, flies are not attracted in great numbers, but the latrine box should be made fly-tight.

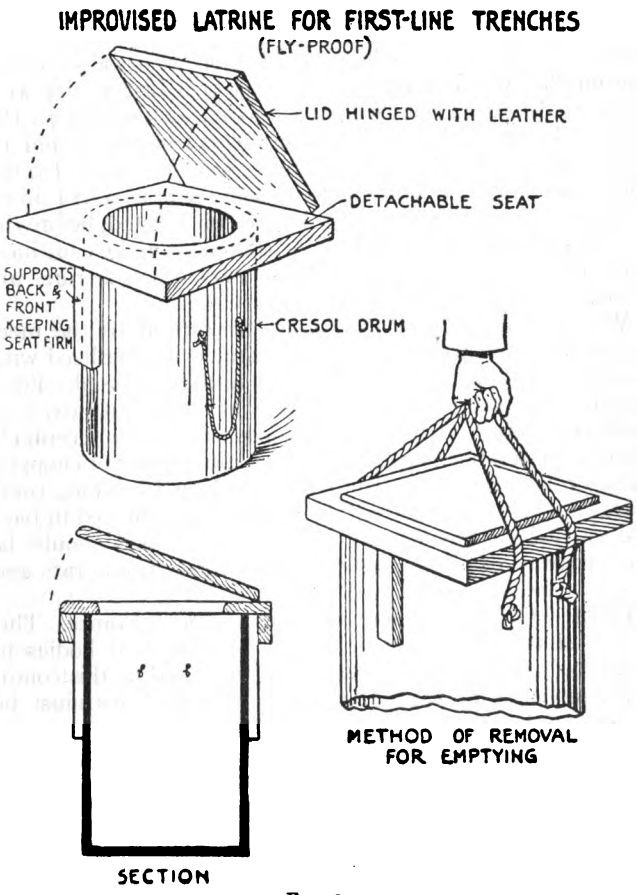
IMPROVISED LATRINE FOR FIRST-LINE TRENCHES
(FLY-PROOF)
LID HINGED WITH LEATHER
DETACHABLE SEAT
SUPPORTS BACK & FRONT KEEPING SEAT FIRM
CRESOL DRUM
METHOD OF REMOVAL FOR EMPTYING
SECTION

FIG. 9.

URINALS.—A urine absorption pit may be made as follows: Fill a pit of 4 to 6 feet deep and 4 feet square with stones or clinkers, covering over the top with sod except in the middle, where a tar-paper funnel or a biscuit tin, with perforated bottom, may be placed to act as a funnel for the urine. In order to repel flies, crude petroleum should be freely used. As the conveniences just described require some time for their construction, some simple device must be used when a trench is first taken or constructed, before the latrine pits can be dug. Fig. 10, taken from Lelean, indicates the principle on which these improvised latrines are made.

WATER.—Water and food must be carried to the men. Water may be carried in cans and should be sterilized with calcium hypochlorite. The Lyster bag may be used. Food may be kept warm by keeping in a jacketted hot box, constructed on the principle of fireless cookers. A tin receptacle is enclosed in a box, surrounded by a 2-inch layer of chopped straw or sawdust. This will retain the heat for a long time.

DÉBRIS AND POLICE.—All débris must be collected in bags and carried to the rear at intervals. No food should be thrown away or allowed to collect, as this attracts rats and flies.

FLIES.—Flies have been very troublesome in France. This is caused to a considerable extent by the dead bodies in front of the trenches in "no man's land," and as this condition cannot be prevented in trench warfare, flies must be present and measures must be taken against them. Fly poisons may be used if there is no other place for them to drink, and under these circumstances will be very effective; but when the trenches are full of water, but little can be expected of this measure. Screening should be used wherever possible, and flies must be kept from latrines and urinals. Food may be kept in small screened boxes, or a receptacle may be improvised as follows: Take a muslin bag of cylin-

drical shape, 2 feet wide and 4 feet long. This bag may be distended with hoops of metal wires or withes, and food may then be hung in this bag, which is tied at the top.

STANDING WATER.—Trenches should be kept free from standing water by means of hand pumps, and whenever possible this should be insisted on as a sanitary measure. Standing in water and mud predisposes to trench foot, and affords an opportunity for the spread of other diseases, among which may be mentioned acute infectious jaundice (Weil's disease). The mud ruins the clothes and equipment and predisposes to the various wound infections.

SLEEPING QUARTERS.—Sleeping quarters should be built, if possible, in small wooden dugouts so that the men can sleep warm and in comfort. Such measures add greatly to the efficiency of the men.

WASHING.—It is not to be expected that real baths can be taken in the trenches, but there is no reason why some provision cannot be made for washing. A reasonable amount of water should be carried to the trenches for washing, and basins may be provided. An absorption pit for wash water may be constructed on the same lines as the urine absorption pit. The British troops have even used braziers for heating water in odd tins for the purpose of washing.

RATS.—Rats have been very troublesome. They may be reduced to a minimum by using the greatest care that there is no food left for them. They may be killed by various rat poisons, by traps, or terriers may be taken into the trenches.

BATHING AND DELOUSING.—As bathing is difficult or impossible in the trenches, it is essential that provision for systematic bathing be made for these men when they return to camp for their period of recuperation. On the Western front bathing and delousing are carried out with the division as the unit. The necessity for system will be seen when it is stated that 160 men must be bathed and deloused per hour

for nine hours a day if each man in the division is to receive a bath every two weeks. This is certainly not an excessive

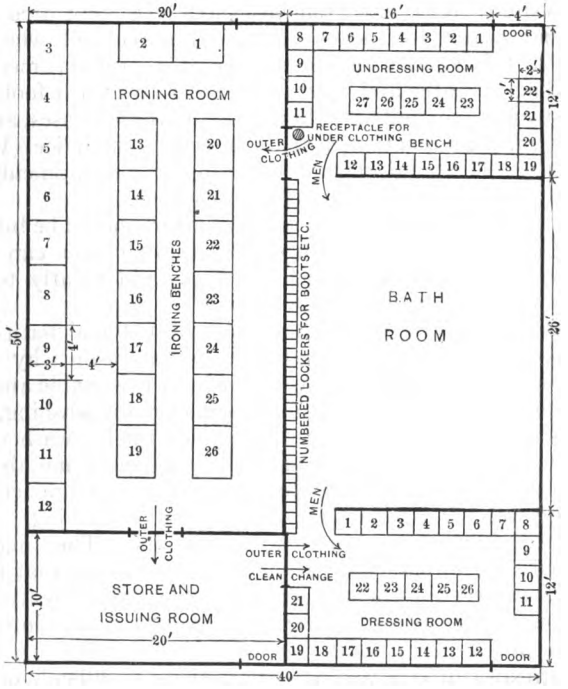

FIG. 10.—From Peacock, The Louse Problem on the Western Front, British Medical Journal, 1916.

requirement, and bathing must at least be as frequent as this. Fig. 11 shows one of the plans used for a divisional bath house, in which ironing of the clothes is relied upon to

rid them of lice. The addition of a sterilizing plant would make this bath house an efficient delousing station.

TRENCH FOOT.—This is a very serious condition, resembling frost-bite and gangrene. It has been claimed that it is caused by a fungus, but it seems probable that this fungus may be found on the feet of any man who stands in the mud, and that it is not the actual cause. The predisposing cause, if not the actual cause, appears to be prolonged exposure to a low temperature not necessarily near the freezing-point, combined with wet. Cases of trench foot were numerous during the winter of 1914–1915, and were practically limited to men standing in water, other troops not being affected to any extent. When for any reason the stay in the trenches was prolonged for several days and nights consecutively at a temperature below 40° F., men and officers often became incapacitated for several months. The most aggravated cases occurred in men who had been on duty several days without removing boots or puttees. Constriction of the circulation in the lower limbs is therefore to be regarded as an important predisposing cause, and this is accentuated by wearing tight boots or shoes combined with prolonged strain in the standing posture.

Prophylaxis.—1. Boots and shoes should not fit tightly, but should be at least a size too large. When boots are large enough, two pairs of socks may be worn, but this is dangerous if the shoes are too small, as it leads to further pressure on the feet. Never use puttees. If leggings must be worn, some other type must be supplied. Rubber hip boots should be furnished if there is standing water in the trench.

2. The general circulation must be kept up by keeping the body warm and dry. Wear water-proof coat if possible when it rains.

3. A dry pair of socks should be carried in the pocket, and boots should be removed at least once in twenty-four hours, the feet rubbed and dried, and the dry socks put on.

If rubber boots are not available the boots should be well greased or oiled.

4. Dry standing should be provided whenever possible. If the trench cannot be pumped out, raise the foot level by fascines of brushwood or straw, with boards on top. Avoid standing still as much as possible. When unavoidable, keep the feet moving.

5. Before going to the trenches the men should have the feet clean. For the prevention of this condition special washing booths have been constructed on the Western front, and the men are sent by companies to these booths just before going to the trench. They wash the feet thoroughly, dry and rub them well and finally cover with a foot powder before putting on socks and shoes. After this treatment the feet remain warm for several hours, and if a fungus is responsible, this treatment tends to remove it.

TRENCH FEVER.—This is a relapsing fever that has been very prevalent in the trenches in Europe and has resulted in considerable impairment of efficiency, although there have been practically no fatal cases.

Etiology.—Is unknown and remains to be worked out. It is claimed that it may be transmitted to healthy men by the injection of washed blood corpuscles, while the plasma and serum are not infective. As the fever is relapsing a spirochete infection is naturally suggested, but search for such an organism has been negative.

Method of Transmission.—Is not known with certainty, but the disease is believed to be transmitted by the bite of infected lice. Cold, wet, and fatigue appear to be exciting causes in those already infected.

Incubation Period.—Appears to be between fifteen and twenty-five days.

Symptoms.—The disease generally begins suddenly with severe frontal headache followed by pain in the lower part of the back, and on the second or third day by severe pain

in the legs. The bowels are regular or constipated and there is no bronchial or nasal catarrh. Tenderness is marked over the lower half of the shins and slight pressure here may cause great pain, though the muscles are not particularly hypersensitive. Leukocytosis is generally present, with a relative increase in the large mononuclear cells. There are two types of fever, a long and a short form.

The Short Form.—The temperature rises rapidly to between 102° and 104° F. On the third or fourth day the temperature falls to normal, but there is no corresponding improvement in the symptoms. After an interval of a few hours the temperature rises again, and then after an interval of from two to five days it falls to normal again, and there is immediate relief, and the patient is often fit for duty almost at once.

The Long Type.—The temperature rises to between 101° and 104° F., and is always lower in the morning than on the preceding and following evening, the highest temperature being reached on the second or third day. The first attack may last four or five days, but after being well for from two to ten days there is a return of headache, pain in the legs, and fever, but the symptoms are less severe than in the first attack. Such recurrences follow periodically for from four to six weeks, each succeeding attack being generally milder than its predecessor until the disease apparently wears itself out.

Diagnosis.—The association of a recurrent pyrexia with tender shins is very suggestive of trench fever. The possibility of malaria must always be considered, but there is no definite rigor, quinine has no effect, and of course malarial parasites cannot be found. In some cases a diagnosis of influenza was made, but there are no catarrhal symptoms, and the definite association of the pain in the bones of the leg is quite different from influenza, as is the recurrent nature of the fever.

Treatment.—No effective treatment has been found. Quinine has been tried but gave no results. Aspirin and phenacetin will relieve pain.

Prophylaxis.—Appears to depend upon the extermination of lice. (See Typhus Fever and Lice.)

TRENCH NEPHRITIS OR WAR NEPHRITIS.—The frequency of nephritis among men on duty in the trenches has excited comment. The disease has apparently prevailed as an epidemic among French and British troops, but if it is due to an infectious agent this has remained undiscovered. The inevitable conditions of military life at the front are predisposing causes if not the determining cause.

The most marked characteristic of this form of nephritis is its relative mildness and favorable prognosis. Edema is the most constant symptom, but soon yields to rest in bed and a milk diet. There may be vomiting, headache, and lumbar pain. The blood-pressure is increased. There is slight albuminuria associated with casts and red blood cells and leukocytes. In some instances blood is present in the urine in sufficient amount to discolor it.

HYGIENE OF THE BATTLEFIELD.

With a battle impending:

1. Make sure of the presence of first-aid packets in good condition.

2. Fill canteen with water. It is always needed by wounded. Inspect equipment of sanitary personnel to be sure they have ample supplies needed for first aid.

3. See that the men are as clean in body and clothing as the circumstances permit. When possible wash with a wet towel and put on clean underclothing, to prevent wound infection as far as possible.

4. Move bowels and empty bladder to avoid extravasation in case of abdominal injury. Food should be nourishing but of small bulk.

5. If injured, the men should be taught to lie still at nearest shelter until rescued. A shell hole affords good protection. Do not seek shelter of underbrush as wounded may never be found in such locations if unconscious.

DISPOSAL OF DEAD.—Bodies may be stripped of outer clothing to promote rapid oxidation and prevent putrefaction.

Dig a pit with sloping sides 35 feet long, 7 feet wide at the bottom and six or seven feet deep. Around the bottom make a small trench draining into a well at the lower end, and fill both trench and well with stones. Good drainage and the absence of water facilitates oxidation and prevents putrefaction.

The bodies are laid across in three or four superimposed rows, the rows being separated by brush or straw or the clothes removed. The pit is then filled with earth which is piled above the ground into a convex or ridged top capable of shedding the rain. The greater the number of bodies buried together, the more rapid will be the disintegration of the bodies.

In selecting sites for pits, care should be taken that they do not drain into nearby watercourses that may be used as a source of water supply.

Identification tags are not removed from the dead but are left on the bodies when interred. Tags found on the bodies of the enemy's dead are collected and turned over to the commander of trains, who sends them to the provost marshall at the base. F. S. R., 1914.

PRISONERS OF WAR.—When prisoners are taken, they should be moved back a short distance to a detention camp. The sick and wounded are segregated and sent to hospital. They are detained here until sick are isolated and those who are well are free from vermin, and are then moved to the prison camp. Upon arrival, they should be detained in isolation barracks for fourteen days. Hair is cut, clothes disin-

fected. At the end of fourteen days they should be mustered and examined again for vermin, and if found free may be sent to permanent barracks or camp.

The prison camp should have its own hospital, and medical officers attached, who should see that the same sanitary orders are enforced that apply in any camp. Effort must be made so far as possible to provide prisoners with all supplies and articles essential to their health, and they should be employed in some useful work. There is a natural human tendency to feel that anything is good enough for alien prisoners, but this feeling should be sternly repressed. We want no American Wittenberg.

The disease most often encountered among prisoners has been tuberculosis, almost always due to poor housing, overcrowding, defective food and other insanitary conditions. In some European camps the morbidity from this disease has reached 2.5 to 3 per cent., and more deaths result than from all other causes combined. Next in order of occurences are the diarrheal and intestinal diseases. All prisoners should be given the antityphoid inoculation, should be vaccinated against smallpox, and should be mustered and inspected regularly to detect infectious diseases. Particular care should be taken that the diet is sufficiently ample and varied to prevent malnutrition and deficiency diseases. When possible the regular army ration should be used.

Prisoners may be organized into companies under their own officers for administrative and sanitary purposes, and these officers may be made responsible for the maintenance of order, cleanliness and general sanitary requirements. Camp inspections must be thorough and cover the same points covered in an inspection of our own troops.

SANITARY ADMINISTRATION OF TERRITORY UNDER MILITARY CONTROL.

The sanitary officers of an invading army are not only morally responsible for the proper sanitary administration of the conquered territory, but they are compelled to perform this work for the protection of their own army. To do this successfully requires familiarity with military methods together with a general knowledge of the organization of state and municipal sanitary departments. Such an organization should include:

I. GENERAL ADMINISTRATION.

1. *Clerical Division.*—Correspondence and current business.

2. *Property Division.*—Purchase, storage and issue of supplies.

3. *Financial Division.*—Receipt and accounting of all money and disbursing office for all salaries.

II. REGISTRATION.

1. *Vital Statistics.*—Births, deaths, issue of permits for burial.

2. *Notification of communicable diseases.*

III. GENERAL SANITATION.

1. *Engineering.*—Construction of buildings, sewers, drainage, filtration plants and other public works.

2. *Inspection.*—Nuisances, disposal of refuse, general sanitary inspection.

IV. PREVENTION AND CONTROL OF COMMUNICABLE DISEASES.

1. *Epidemiology.*—Investigation of the source of all infectious diseases, and recommendation of measures to prevent spread.

2. *Laboratory.*—Both diagnostic and research—investigation of cause of epidemics.

3. *Hospital Division.*—Transportation and treatment of sick, isolation hospitals.

The headquarters should be central and easy of access.

The chief administrative officer should be an experienced sanitarian from the Army Medical Corps. He should be directly responsible to the Commanding General and subject to no other authority. Other medical officers may be used as chiefs of divisions and the civilian physicians in the neighborhood should be employed either as sanitary inspectors or in the hospitals. The chief of the engineering division may be an engineer officer detached for this duty, but should be under control of the sanitary officer. A suitable number of clerks and messengers is essential. These may be secured from the men of the medical department, from the existing organization, or they may be hired.

Obtain maps as soon as possible. Divide the city or territory into districts of suitable size, and place a sanitary inspector in charge of each district. This man may be a medical officer or a civilian, preferably the latter if men of ability and responsiblity can be obtained. He will understand the language and customs of the inhabitants better and may be able to secure better results for this reason. There will never be sufficient medical officers for the entire personnel, and success will depend upon ability to use civilian physicians where they can serve best. Each district inspector should have under him a personnel sufficient for the work to be performed. It is much better to start with a large personnel and reduce it as sanitation improves than to start with a small personnel unable to cope with the situation and necessitating constant enlargement. Laborers for sanitary purposes may be secured from prisoners, or from hired civilians, the latter being better when money is available, and such sanitary squads should be in charge of a non-commissioned officer. Money for such sanitary purposes may be obtained by taxation or from military funds.

The district sanitary officer should make constant and thorough inspections, using a regulation form that can be filed in district headquarters as a record. Defects found may

be corrected by the owner of the premises under penalty of a fine, by the sanitary squad under the direction of the inspector or, if a matter of police only, by the provost guard.

In performing this work, active or passive opposition may be expected and should be dealt with gently but firmly. Do not irritate by unnecessary use of military power in non-essentials, but use it unhesitatingly when absolutely necessary. It should be remembered that more can be accomplished by obtaining the good will of the population than by force. It should be made plain that the action is being taken for their own protection.

As soon as organization is completed, a precise and detailed sanitary order should be issued to all inhabitants. Whenever possible this should be based on previous sanitary laws in order to avoid unnecessary innovations, and should always be in the language of the country.

The home life of all non-combatants must be respected. Refugees should be returned to their homes if possible, first ascertaining that they are free from disease. Provision must be made for those having no homes, and public buildings, schools, churches, warehouses and similar buildings may be used, or temporary quarters may be built. All such quarters must be carefully inspected to ensure compliance with sanitary regulations. It may be necessary to issue rations to those who are without means of support. Every effort should be made to evacuate such camps as soon as possible.

All public institutions, including jails, asylums and hospitals should be inspected at once, and measures taken to place them in a sanitary condition.

Proper water supplies, scavenger service, and other services ordinarily performed by health departments should be undertaken as rapidly as funds and personnel will permit.

The epidemiologist should investigate, with the assistance of the laboratory, each case of infectious disease that is

reported and the proper steps taken to prevent its spread. Reporting of serious infectious diseases may be controlled to a great extent by refusal to issue a permit for burial to cases dying under suspicious circumstances until a post-mortem has established the diagnosis. Any physician issuing a false certificate to evade the military regulations may be penalized.

INSECTS CONCERNED IN THE TRANSMISSION OF DISEASE.

FLEAS.

CLASSIFICATION.—Suborder Apheniptera or Siphonaptera. Family Pulicidæ. While there are about 200 species, there are only three genera and a few species that are of medical interest.

1. Genus Pulex. Pulex irritans.
2. Genus Xenopsylla X. cheopis.
3. Genus Ctenocephalus C. canis.

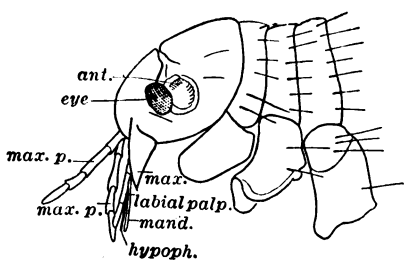

FIG. 11.—Pulex irritans.

PULEX IRRITANS.—The human flea. This species can transmit plague, but is not practically concerned in the transmission of that disease because in nature it almost never bites rats. It may be identified by the fact that it has no combs, and has a single preocular bristle.

XENOPSYLLA CHEOPIS.—This is the rat flea of the tropics, but also bites man readily. It therefore leaves the body of the rat after it has died of plague, and if no other rat is available as a host it attacks man. This flea is the ordinary

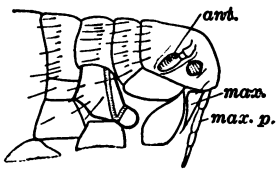

FIG. 12.—Xenopsylla cheopis.

and usual plague transmitter. It looks somewhat like the human flea but may be identified by the fact that it has a V-shaped row of bristles on the posterior and lower border of the head. *There is also a suture on the mesopleura.* There are no combs, and there is a preocular bristle.

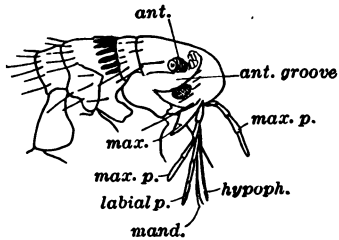

FIG. 13.—Ceratophyllus fasciatus.

CERATOPLHYLUS FASCIATUS.—Is a fairly common rat flea, especially in Europe. It can transmit plague, but is not usually concerned. It has a row of combs on the pronotum, but none on the head.

CTENOCEPHALUS CANIS.—The ordinary dog and cat flea, but may also be found on rats and man. It is of no practical importance in the transmission of plague, but transmits the tape-worm Dipylidium caninum. It is easily identified by the double row of combs, one on the lower border of the head and one on the pronotum.

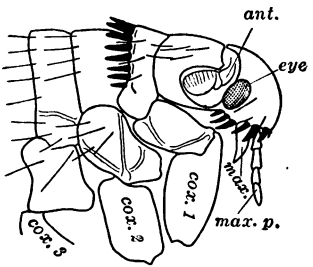

FIG. 14.—Ctenocephalus canis.

Life History.—Three to eighteen eggs are laid. These are large (0.5 mm. long), glistening, white and blunt at both ends. In some species the eggs are laid in the cracks of the floor or in loose earth. In other species they may be deposited on the dog or other animal, but the dry eggs fall off readily and myriads may be found in the bed of a flea-infested animal. Development always takes place on the floor or ground. The length of time required for development of the egg depends upon the temperature, and may last from two to fourteen days, at the end of which the embryo cuts its way out of the egg with the sharp horn on its head. The larva is worm-like, with thirteen segments, and is very slender and active, with mouth parts of the biting type. It lives chiefly upon excrementitious matter, including the feces of the adult flea, which often contain undigested blood. The larval stage requires seven to thirty days, depending upon circumstances.

At the end of the larval period the insect spins a whitish silken cocoon in which the pupa rests, and the fully developed flea emerges in from ten to fourteen days. Under ordinary circumstances it may be estimated that it takes about a month from the egg to the adult flea.

LONGEVITY OF FLEAS.—Laboratory experiments indicate that when deprived of an opportunity of feeding, fleas die in six days or less. Rat fleas fed on human blood averaged eight and a half days (maximum seventeen) for the males and thirty-two days (maximum 160) for the females.

REPELLANTS.—Essential oils have a stupefying effect on fleas when used in strong concentration. It is probable that rubbing the body with oil of citronella would repel fleas.

DESTRUCTION OF FLEAS.—If the larvæ are killed, fleas will soon disappear. Kerosene and miscible oil are extremely efficient pulicides. Floors and the ground under houses may be thoroughly sprinkled with kerosene, and the posts supporting the houses may be smeared with crude oil. Very few other substances will serve; water, glycerin and alcohol are inefficient, and formalin, phenol, mercuric chloride and tricresol in the strengths used as disinfectants are of little value in killing fleas. Powdered sulphur has also been found to be of no value. The fumigants bisulphide of carbon, hydrocyanic gas, and sulphur dioxide are highly efficient, but the first two are dangerous, and should only be used by those instructed in their use.

To Collect Fleas from Plague Houses.—Leave several guinea-pigs in the house for a day or two. Then anesthetize to stupefy the fleas and comb the fleas from the hair, dropping them in kerosene. The species of fleas found in plague houses may be determined in this way.

FLIES.

Flies are not only a great nuisance in camp but they spread many diseases, including typhoid and the dysenteries, and

for this reason the greatest care must be taken to prevent fly breeding and the access of flies to food or excreta. The fly that causes the most trouble is the common house fly (Musca domestica). This fly cannot bite. The stable fly (Stomoxys calcitrans) looks much like the house fly, and is a savage biter. Because of this fact the stable fly is not as dangerous as the house fly as a disease transmitter, but it is an even greater nuisance. In order to combat flies, some knowledge of their life cycle, and particularly of their breeding habits, is absolutely necessary. The breeding habits of the house fly and the stable fly are practically identical, so that for sanitary purposes they may be considered together.

LIFE CYCLE.—The adult house fly lives chiefly in human habitations, and 98 per cent. of the flies found in dining rooms and kitchens are Musca domestica. Female flies begin depositing eggs from nine to twelve days after emerging from the pupa case. From seventy-five to one hundred and fifty eggs are deposited singly, piling up in masses, and there are usually two to four such layings at intervals of three or four days. *Horse manure* is the favorite material upon which eggs are deposited and upon which the larvæ feed, but they commonly develop also in human feces, kitchen refuse, and other decaying organic matter. Probably when horse manure is not carefully removed, 95 per cent. of the flies originate from this source. Therefore in any campaign against flies the disposition of horse manure must receive the most attention. It must not be forgotten, however, that flies breed in *any* decaying organic matter, and will often lay their eggs upon the ground around garbage cans and incinerators which has become soiled by throwing slops at the can or incinerator instead of pouring them into these receptacles.

The eggs of the house fly hatch in from twelve to twenty-four hours, and the larvæ begin feeding at once and grow rapidly. The larval stage is the growing period of the fly, and the size of the adult will depend upon the size the larva

attains. The larval stage lasts from four to six days, after which the maggots leave the manure pile and burrow into the ground beneath it, where they pupate or go into a resting stage, during which the transformation to the adult fly occurs. The time required from the laying of the egg to the emergence of the adult fly is from ten to fourteen days in warm weather. Cold weather lengthens the period of development.

It is important to note this habit of the maggots of burrowing into the earth to pupate. The ground around picket lines, or where kitchen wastes are thrown, may contain millions of these larvæ or pupæ, even though the manure and wastes are removed. Throwing fresh earth upon these places not only does no good, but favors the development of the flies, which can emerge through six feet of earth. Burning the ground over will not destroy larvæ that have already penetrated the ground, for the heat does not penetrate the ground more than an inch or so. The only method of preventing this source of breeding is to remove all manure promptly (daily), and even then flies will lay their eggs on the soil around the remnants that escape and the larvæ will gain access to the soil. (See care of Picket Lines.)

RANGE OF FLIGHT.—Ordinarily flies remain near the place where they originated, and when flies are numerous, search should be made near by for breeding places. However, when food is not abundant near by, flies may travel several miles, as has been proved by observation and experiment.

LONGEVITY OF FLIES.—Under ordinary conditions flies live from thirty to sixty days during the summer months. They may hibernate and live over the winter.

FEEDING HABITS AND DISEASE TRANSMISSION.—The mouth parts of the house fly are fused into a proboscis, so that it cannot bite and cannot eat solid matter. It obtains solid matter, such as sugar, by regurgitating droplets from its stomach upon the food, and then sucking them back after

these droplets have dissolved some of the food. As many disease organisms may remain in a virulent condition in the intestinal tract of flies, these may be readily deposited upon the food in this way. It has been shown experimentally that living typhoid bacilli may remain in and upon the bodies of flies for as long as twenty-three days after infection, and they excrete tubercle bacilli for at least six days after feeding on tuberculous sputum; the eggs of various parasitic worms may also be carried by flies. In addition to regurgitation the fly defecates frequently while feeding, and disease organisms are also deposited on the food in this way. The fly is particularly fond of the food prepared in the kitchen and also of human feces. It frequently travels from the latter to the former and wipes its feet on the food. Should disease organisms be present in the stools of carriers or actual cases of the disease they may therefore be carried directly to the food by flies, on their feet, by defecation and by regurgitation on the food.

ELIMINATION OF FLIES FROM CAMP.—I. Measures directed against fly breeding. These subjects are dealt with in special notes.

1. Prompt disposal of manure.
2. Incineration of all garbage and kitchen wastes.
3. Sanitary disposal of human feces in fly-tight latrines.

II. Measures to kill adults already present.

1. Fly traps.
2. Fly papers and poisons.

III. Measures to prevent access of flies to food.

1. Screening of kitchens and mess halls.

Fly Traps.—Are constructed on the principle that flies are attracted through the dark opening at the bottom of the trap by the sense of smell. After feeding, they attempt to leave by flying toward the light, and so enter the trap. Traps must therefore be raised a sufficient distance from the ground to allow free access to flies, and must always be baited with some attractive odorous substance. Flies will not

enter a trap that is not baited properly, but in spite of this fact, in many camps traps have been left without bait. An old decaying fish head or the following solutions may be used: Molasses one part to water three parts; brown sugar one part to water four parts. Both of these solutions are more attractive after they have fermented. Vinegar and sugar may be used or sour milk. Whenever flies are numerous, fly traps should be used both inside and outside the mess halls and kitchens in the number prescribed by the sanitary officer, and daily inspection of these traps should be made, to ensure that they are baited properly and working efficiently (see Fig. 16).

Sticky Fly Papers.—Are fairly efficient and may be purchased from the mess funds and used if desired.

Fly Poisons.—Are very efficient and safe when properly prepared. A good fly poison should be attractive to flies, for it may be assumed that there are alternative drinking places. Formaldehyde in a concentration of 0.5 to 1 per cent. is attractive to flies, and is more efficient than any other fly poison. Sodium salicylate in 1 per cent. solution is almost as efficient, and is easier to keep and handle. A formaldehyde solution of 1 per cent. corresponds to 2.5 per cent. of the 40 per cent. solution sold as formalin. If accurate solutions cannot be obtained, use 3 teaspoonsfuls of 40 per cent formaldehyde to the pint of water, or 3 teaspoonfuls of powdered sodium salicylate to the pint.

Directions for Use.—Nearly fill a glass tumbler with the solution, place over this a piece of blotting paper, cut circular and somewhat larger than the tumbler, and over this place a saucer. Invert the whole device, and insert a match or toothpick under the edge of the tumbler to permit access of air. The blotting paper will remain in the proper moist condition until the entire contents of the tumbler have been used. A very little sugar sprinkled on the paper may increase the attractiveness of the poison for the flies, but care should

be used not to use too much. These poisons kill flies in a few minutes after drinking. Flies drink best in the early morning, and the poison should be set at night so that it will be ready.

Fly Swatting.—Should flies gain access to the kitchens or mess halls, they may be killed by swatting. It should be understood, however, that this is the poorest method of killing flies and indicates that the other methods outlined

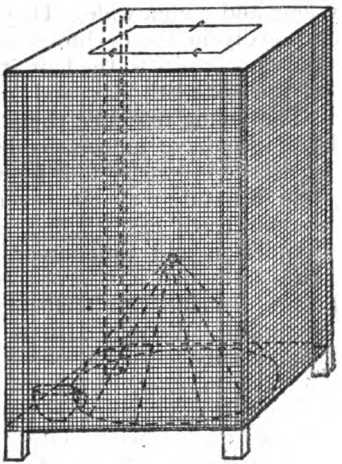

FIG. 15.—Fly trap, as made by company artificer. (Keefer, Military Hygiene.)

are not being carried out efficiently. If fly breeding is controlled, fly screening is effective, and poisons and traps used to kill the few flies that enter the kitchen and mess hall, there should be little opportunity for fly swatting, a method that is time-consuming and inefficient.

LICE.

CLASSIFICATION.—Order Hemiptera; suborder Aptera; family Pediculidæ.

Genus 1. Pediculus. 2 species, P. capitis and P. vestimenti. Thorax and abdomen separate.

Genus 2. Phthirius. P. inguinalis. Large thorax not separated from abdomen.

P. CAPITIS. *Head Louse.*—Of gray color, *abdomen composed of seven segments.* Male 1.6 mm. long by 0.7 mm. wide. Female 2.7 mm. long and 1 mm. wide. They live in the hair of the head, occasionally in the eyebrows and beard. The female attaches the eggs or nits to the hair at the base. The young emerge on the sixteenth day and are adult on the eighteenth day. The young resemble the adult except that they are smaller. Lice have an insatiable appetite, and must be fed at least once in twenty-four hours to keep them alive, and in a state of nature may bite several times a day. The adults are comparatively easily killed, but the eggs are very resistant. Anderson and Goldberger showed that it can transmit typhus, although it is probably not the usual transmitter. Foster described an epidemic of typhus in Mindanao due to capitis. We may assume that the young are not infected hereditarily.

P. VESTIMENTI.—The *clothing louse,* often erroneously called the body louse. It never lives on the body but lives entirely in the clothes even when it bites. To find these lice the clothing must be searched, not the body. It is larger than P. capitis, the male being 3 mm. long by 1 mm. wide, the female 3 mm. long by 1.1 mm. wide. *The abdomen is composed of eight segments.* Head is less rounded than capitis and has longer antennæ. Eggs are never laid on body hair, but in clothes, particularly in seams. The insect moves very rapidly and hides in folds and seams and many not be found unless a thorough search is made. Evolution same as capitis. They also bite frequently and are difficult to keep

alive away from the body. A slight elevation of temperature kills them, and it is said that a man from Mexico City, where it is cool, comes down to Vera Cruz lousy but loses them all in a few days because of the increased heat. Body lice are said not to be found in the tropics. They also need a daily feed. *Is the common transmitter* of typhus. Not transmitted to young by heredity. The eggs are very resistant. Dry heat may not penetrate to them, especially when the clothing is placed in bags. Steam or boiling water are best. The fact that so many things have been suggested as disinfectants shows how unsatisfactory they are. The duration of life on the body is not known, but it may be seven or eight weeks. As the result of many experiments, it has been found that the longest period during which lice survived separation from the human body was about nine days. Eggs may remain dormant away from the body for forty days. Eggs on clothing may therefore serve as a source of infestation for about a month at least. Lice may travel considerable distances when separated from the body. They have been observed to travel five feet horizontally and three feet up the wall of a room.

PHTHIRIUS INGUINALIS. *Crab Louse.*—The head is relatively short and engaged in a depression in the thorax which is larger than the abdomen. The abdomen is formed of six rings, but the second, carrying three stigmata, is formed from the fusion of the second, third, and fourth segments. The feet are armed with powerful claws. The males are about 1 mm. long, the females about 1.5 mm. long. They live habitually in the hair of the pubis and perineum, but may rarely attack the hair of the beard, moustache, eyebrows, etc. The eggs are fixed at the base of the hairs, and the young are born on the seventeenth day and may reproduce fifteen days after birth. It is easily distinguished from the other two species of lice, because there is no separation of thorax and abdomen. It is naturally suggested that it may

have something to do with typhus fever, but no experimental work has been done. It is not likely that it is important as a transmitter, because its habits are not in keeping with the known epidemiology of typhus. Like other lice the eggs are very difficult to destroy.

FIG. 16.—Body of *C.* when resting is held parallel to wall in a curved position. (Park.)

FIG. 17.—Body of *A.* stands at an angle of about 45 degrees and is straight. (Park.)

MOSQUITOES.

In this discussion of mosquitoes no attempt is made to describe details of structure or classification, but to present the minimum of classification which should be accessible to every medical officer in order that he may perform his sanitary duties efficiently. For further information see Bulletin No. 4, W. D., Office of the Surgeon-General.

CLASSIFICATION.—Family Culicidæ, subfamilies Anophelinæ and Culicinæ. The males do not bite, but the females must have a meal of blood before they can lay their eggs. Since the males do not feed on blood they are less frequently found about habitations, and the female is generally used for classification. The males of most species have plumose or

feathery antennæ, while in the female, as a rule, these organs are slender, thread-like, and covered with short lateral hairs.

SUBFAMILY ANOPHELINÆ.—Mosquitoes with straight proboscis; palpi long in both sexes; occiput mostly with upright, forked scales, never with flat, lateral scales. Thorax

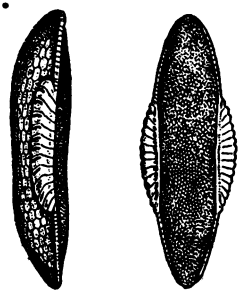

FIG. 18.—Egg of Anopheles maculipennis. On the left the egg is seen from above, and on the right from the side. (Nuttall and Shipley.)

with scales or hairs; postscutellum nude; abdomen with scales or hairs. Eggs are laid singly and not in rafts. Larvæ without respiratory siphon. Adult assumes characteristic resting position.

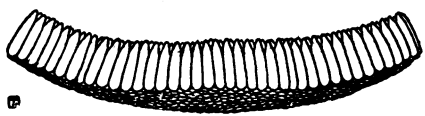

FIG. 19.—Raft of culicine eggs. (Sambon.)

The anopheles contain about eighteen genera, of which only two are of medical interest. In both of these genera the first submarginal cell is large; antennal segments with lateral

scale tufts; thorax and abdomen with hair-like curved scales. No flat scales on the head. Basal lobe of male genitalia consists of one segment.

Genus Anopheles. Wing scales large and lanceolate.

Genus Myzomyia. Wing scales mostly small, long, and narrow.

Species Concerned in the Transmission of Malaria.—No anopheline mosquito should be trusted, but comparatively few species have been actually demonstrated to transmit malaria. It must always be remembered that while many

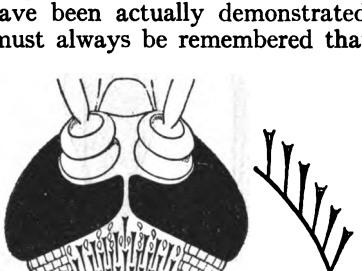

FIG. 20.—The occiput and scutellum of an anopheline mosquito to show the scale characters. At the side is seen the lateral aspect of the vertical scales. (Theobald.)

species may become infected in the laboratory, that in a given locality usually only one or at most several species are concerned in the transmission of the disease. These species are suitable hosts for the parasite, become infected in practically 100 per cent. of cases, and the parasite practically always finishes its full cycle of development in this mosquito. Other species become infected in possibly 10 per cent. of cases, and the parasite completes its life cycle in only a few of these. Of the few that become infective the chances are that they

die or never succeed in biting man again. So that while such species may be shown to be capable of transmitting the disease in the laboratory, they are not actually transmitters of the disease in nature. A. quadrimaculatus and A. crucians and A. punctipennis are the most dangerous North American species. A. albimanus and A. argyrotarsus are the most

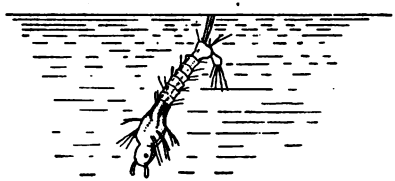

FIG. 21.—Larva of *C.* hangs nearly at right angles to water surface. (Park.)

important species for Central America. In the Southern States, A. quadrimaculatus is probably the principal carrier of malaria. A. maculipennis is the most important European species. Myzomyia funesta or Christophersi, and called by Walker and Barber Myzomyia febrifera, is apparently the

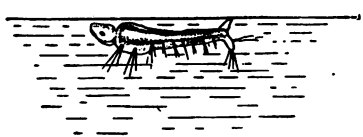

FIG. 22.—Larva of *A.* are parallel to surface. (Park.)

mosquito mainly concerned in the transmission of malaria in the Philippines.

Not all species of anopheles carry all forms of the malarial parasite equally. Thus A. crucians is a most important carrier of the estivo-autumnal parasite, but is said not to transmit other forms of malaria.

The important point in this for the sanitary officer is that he should determine what mosquito is responsible for the transmission of disease in his locality, and then should learn everything possible about the habits of that particular mosquito in order that he may direct an intelligent campaign against it. If that mosquito is breeding about the house it will do no good to carry out extensive drainage operations. The particular mosquito at fault can usually be identified very easily by an expert, and for this purpose the assistance

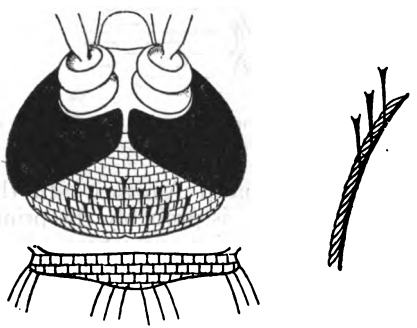

FIG. 23.—Head and scutellum of Stegomyia, to show scales. (Theobald.)

of an expert entomologist should be secured whenever possible. When this is not possible, collect samples of mosquitoes taken at various hours of the day and night, place them in labeled pill boxes, adding a single small drop of formaldehyde to the cotton as a preservative, and send them by mail to the Army Medical School, Washington, D. C., for identification.

SUBFAMILY CULICINÆ.—Mosquitoes with straight proboscis, long palpi in the male, but short in the female; Scutellum trilobed, postscutellum nude; wings with long first submarginal cell, and without a third anal vein. Larvæ

with respiratory siphons. Eggs usually laid in masses. There are upward of sixty-three genera, but of these only three, Stegomyia, Culex, and Mansonia, are of medical importance.

1. *Genus Stegomyia.*—Culicinæ, with head and scutellum clothed with flat scales, with a few upright forked scales interspersed. (Scales may be examined by mounting the mosquito on a slender pin and holding it under the microscope; the two-third objective should be used.) Stegomyia fasciata (calopus) transmits yellow fever, and some experiments indicate that it also transmits dengue.

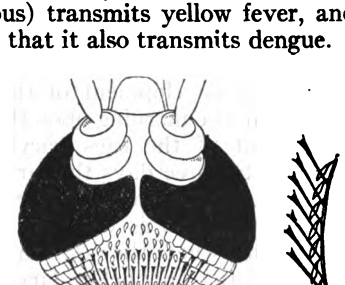

FIG. 24.—Head and scutellum of Culex, to show scales. (Theobald.)

2. *Genus Culex.*—Occiput covered with flat scales at the sides, and mixed upright forked scales and narrow curved scales in the middle; thorax and scutellum with hair-like curved scales or narrow curved scales. Culex fatigans is a probable transmitter of dengue.

3. *Genus Mansonia.*—Common in the Philippines and in Panama. The scales on the head and thorax are the same as in Culex. The wing scales, however, are very thick, broad and truncated, so that it looks like a mosquito covered with mildew. It frequently breeds in the water at the base of

banana leaves. In the case of M. titilans, neither larva nor pupa is compelled to come to the surface to breathe, therefore oiling does not destroy them, but they may be killed by larvacides that diffuse in the water. Mansonia uniformis carries Filaria bancrofti, but no other disease so far as known.

Life Cycle.—A mosquito passes through a complicated life cycle with a complete metamorphosis, including the egg, the larva, the pupa, and the perfect insect or imago. Soon after the female is liberated from the pupa case it is fertilized. The eggs are not laid until after a meal of blood, which seems to be necessary for the development of the eggs. About 100 eggs are laid early in the morning upon the surface of the water, the arrangement of the eggs varying in different species. In from two to three days the larva escapes from the egg and grows rapidly. These larvæ are very characteristic, and are popularly known as wigglers. They come up to the surface to breathe, where the position assumed by the larva is also characteristic; anopheline larvæ have no long respiratory siphon, and lie parallel to the surface while culicine larvæ hang head downward from the surface. When disturbed they swim to the bottom by jerks. The duration of the larval stage varies with food and temperature, and may be from eleven to twenty-one days or longer under unfavorable conditions. The larva then goes into a resting stage or pupa which lasts about forty-eight hours, during which time the transformation to the adult mosquito occurs. Pupæ do not eat but must come to the surface to breathe. When the development is complete the pupa comes to the surface of the water, the dorsal portion of the thorax splits open, and the adult insect emerges, dries its wings while supported on the pupa case, and flies away. Oiling kills the larvæ because they are unable to project the siphon through the film of oil and therefore cannot breathe.

The adult insects generally bite at night, and this is par-

ticularly true of anopheline mosquitoes, hence the bad reputation that night air formerly had. Stegomyia, on the contrary, bites freely during the daytime. It is very quick and active, and is very erratic in its flight, so that it is very difficult to catch. In yellow fever countries great care must be taken to avoid being bitten by this mosquito.

It is not known exactly how long mosquitoes live, but it is known that both adults and larvæ can hibernate and live over until the next season. Eggs may be dried for several years and still hatch out.

FLIGHT OF MOSQUITOES.—It is usually supposed that mosquitoes do not fly far from their breeding place, and no doubt this is a general rule for many species. The Stegomyia particularly tends to remain about the houses where it originated, and thus in the days before the transmission of the disease was understood, certain houses came to be known as yellow fever foci. But Le Prince has shown that A. quadrimaculatus may fly as far as a mile from its breeding place, and that they can cross a river of 800 feet width. Such possibilities must always be kept in mind, and while it is always best to look first for breeding places nearby, when mosquitoes are abundant and these nearby breeding places cannot be found the ground must be thoroughly studied over a considerable area.

SANITARY MEASURES.—I. *Reduction of Number of Mosquitoes to the Point where Infection Will Not be Transmitted. Methods Directed against the Adult Insect.*—1. Clear away all dense vegetation. This deprives the insect of shelter and exposes possible breeding places. In the Canal Zone all vegetation was removed for 200 yards around all habitations.

2. Fumigation of rooms, especially those from which patients are removed.

3. Destruction by traps, swatters, etc. Even in a screened building daily inspection is recommended to kill adult insects

that have entered. Many methods for killing mosquitoes are recommended. In the Philippines the following device has proved effective. Take a piece of medium-weight wire and bend it in the form of a tennis racquet, but much smaller. Twist this through a heavy spider web and apply it gently over mosquitoes on the wall. The mosquitoes fly into the spider web and are caught. Le Prince used mosquito traps in Panama, where a trap might catch several hundred mosquitoes a night. When catching mosquitoes for study or identification use the following killing tube. Take a camel-hair brush-tube, or a large test-tube, and pack the bottom with an inch layer of small rubber bands. Hold in place by a plug of absorbent cotton and a disk of blotting paper. Pour in a few cubic centimeters of chloroform and cork tightly. The chloroform is absorbed by the rubber bands and the tube will remain effective for several days, the chloroform killing the insect when the tube is placed over it.

II. *Methods Directed against the Larva.*—1. Engineering Works.—Draining of swamps and roads, training streams, ditching.

2. Organization of mosquito brigades under trained supervisors who remove all small collections of water, spray, and oil other collections every ten days, screen wells, cesspools, and cisterns, keep streams and drains free of water plants, etc. All gutters of houses and bamboo joints to be properly drained. A search is maintained in all possible places for larvæ and all breeding places destroyed.

III. *Reduction in the Number of Bites.*—Even though mosquitoes are numerous, they cannot become infected unless they can bite a patient having malaria, and they must bite again to transmit the infection. Therefore:

1. *Screen all Malarial Patients.*—Such patients should be kept in a properly screened ward with a double door, and in addition should sleep under a bed net, since a few mosquitoes may gain access even to a screened building.

2. *Use Screening Generally.*—Screen beds, houses, and in malarial districts, sentries and all men obliged to remain out at night should protect themselves by wearing headnets, gauntlets, etc. Inspect screening daily to be sure it is effective.

3. *The Use of Protective Oils.*—Oil of citronella will keep mosquitoes from biting if applied frequently enough, but it evaporates rapidly. Smudges may also be used. Such methods are not of much value except at such times and places when the other methods outlined above cannot be carried out.

IV. All of these measures must be combined with education by means of lectures or informal talks, and the use of mosquito bars must be enforced by a post or camp order, followed by inspections to make sure the order is obeyed. The average soldier does not understand the transmission of malaria, and may think the regulations foolish or unnecessary. The good soldier will obey the orders on principle, but the sanitary officer must be prepared to deal with chronic offenders who refuse to use mosquito bars. Some must be tried. Much trouble will be avoided, and active coöperation may be secured on the part of non-commissioned officers and others if the men are instructed on the part played by the mosquito in the transmission of malaria and the necessity of avoiding being bitten, particularly at night. More care will be taken to avoid injury to the screening of buildings, and many men may be trained to search the barracks for anophelinæ in the morning. Any soldier may be trained to recognize an anopheles by showing him the characteristic posture of this mosquito on the walls, and they should be taught to look for them in the dark corners, under lavatories, and similar places where this mosquito hides during the day.

Fumigation of Rooms.—Sulphur is best when it can be used, for it kills mosquitoes. It must be remembered that sulphur dioxide injures most metallic substances and fabrics, and these

should be removed before fumigation. To determine the amount of sulphur to be burned, divide the cubic feet by 500, reading the result in pounds. A room 40 + 20 + 12 would contain 9600 cubic feet, so that 19.2 pounds of sulphur should be burned. Use strict precautions against fire. It is difficult to start sulphur burning. Put a little pyrethrum on top, add alcohol to this, and light.

When sulphur cannot be used, pyrethrum may be used. Burn 1 pound of pyrethrum to each 1000 cubic feet. The mosquitoes are stupefied but not killed, and must be swept up afterward and burned. Tobacco stems 2 pounds to 1000 cubic feet, may be used, or camphor 1 part, phenol 3 parts, using 1 ounce of this mixture for each 1000 cubic feet. Sweep up mosquitoes and destroy when all of these preparations are used except sulphur.

Mosquito Traps.—Have been used extensively in the canal zone. The trap consists of a half-cylinder of wire netting, having two ridges inside it, the apices of which are perforated by longitudinal slits about $\frac{1}{4}$ inch wide and 3 inches long. Through the slits in these ridges the mosquitoes enter the chamber of the trap and cannot find their way out again. The traps are so placed as to catch mosquitoes entering a building. In the Canal Zone it was found that more anophelines were caught if the traps were placed in the lee of the building, while more culicines were caught if the traps were installed on the windward side of the building.

Ditching.—Small accumulations of water may be removed by filling, but all large breeding places for mosquitoes should be drained if possible. There are several methods of drainage, the choice of which must depend upon relative cost and the circumstances of time and place.

1. *Open Ditches.*—May be satisfactory if there be enough slope to give a swift current; otherwise they become clogged with algæ, and furnish a breeding place, so that they must be kept open, cleaned and oiled weekly. The method is

unsatisfactory and costly from the continuous employment of labor.

2. *Blind Drains.*—Recommended if better cannot be obtained. A culvert is made and lined with flat stones and filled with first large, then small stones. A good grade is essential. It may become blocked, but does not harbor anopheles.

3. *Cement-lined Open Drain.*—Only form that should be adopted in the tropics and should have a considerable grade. It is semicircular in shape. If there is a good grade, they will keep themselves clean by flushing.

4. *Subsoil Drainage with Tiles.*—Le Prince says it is most economical and permanent method of destroying anopheles in the tropics. It costs from 16 to 20 cents a foot or more, depending upon the locality. It is recommended that they should not have a flatter grade than 0.5 per cent., while as high as 5 per cent. gave perfect satisfaction if the tiles were covered with plenty of stone to hold them in place. If any considerable amount of drainage is to be constructed the assistance of an engineer should be secured.

Oiling.—Oil kills mosquito larvæ by forming a surface film through which they cannot project the respiratory siphon. Accumulations of water that cannot be drained may be oiled. Any crude petroleum may be used, but experience has shown that the best results are obtained with oils of certain grades. If 4 parts oil of 18 degrees gravity be mixed with 1 part of 34 degrees gravity the resulting mixture will remain efficient for from three to four weeks after application. The temperature and sun make many variations as well as the grade of oil. Since the life of the larvæ is from ten to fourteen days the most sensible rule would be to reoil every two weeks. The exact interval should be determined by inspections. The oil may be applied by a force pump and a straight nozzle for large bodies of water, and a spray nozzle[1]

[1] A knapsack spray pump for oiling small accumulations of standing water is made by F. E. Myers & Bros., Ashland, Ohio.

for small accumulations of water. Care should be taken to see that there are no portions of the surface left uncovered by oil.

Larvacide.—Where there is considerable rainfall oil may be rapidly swept away, and, moreover, there is one species, Mansonia titilans, which is not killed by oil, as it does not come to the surface but gets its air from the roots of water plants. Under these circumstances the following larvacide, which was extensively used on the Canal Zone, may be recommended: 150 gallons of crude carbolic acid (specific gravity not greater than 0.97 and to contain not less than 30 per cent. tar acids) are heated in an iron tank having a steam coil with steam at 50 pounds pressure; 200 pounds of finely crushed and sifted common rosin are dissolved in the heated acid, and then 30 pounds of caustic soda, dissolved in 6 gallons of water, are added. There is a mechanical stirring rod attached to the tank. The product is ready in a few minutes, yielding about 3½ barrels. It is necessary to keep the specific gravity of the product approximately that of water so that it will diffuse rapidly and neither remain on top or sink to the bottom. About 200 barrels a month were used in Panama to treat 100 square miles of territory. Before using as a spray 1 gallon may be diluted to 6 gallons with water, and the resultant mixture may be sprayed over accumulations of water. One part emulsion to 5000 parts of water will kill anopheles larvæ in from five to ten minutes. In addition, larvacide kills the algæ and thus destroys the food and hiding places of the larvæ. It is also a good disinfectant, having a Rideal-Walker coefficient of from 2 to 5.

Disadvantages.—It does not emulsify and is inert in brackish water. It deteriorates on exposure to air and must be kept in kegs. It loses toxicity rapidly when mixed with water.

Cost.—On the Isthmus, its cost varied from 14 to 17 cents a gallon.

Screening.—Screening material should be composed of copper when possible. Iron screening is not durable and

costs more in the end. If iron be used it must be painted. For anopheles, sixteen meshes to the linear inch is sufficient, but to exclude stegomyia, eighteen meshes to the linear inch is necessary. Such screening in the past cost 50 cents per square yard. In temporary quarters where such expenditure would not be justified, quarters may be screened with ordinary cotton mosquito netting or with a cheap grade of lawn. Le Prince states that the screening of dwellings alone reduces the malarial rate at least one third.

Mosquito Bars, Headnets.—These appliances are issued by the Quartermaster's Department, and mosquito bars are also issued by the Medical Department for hospital use. When in malarial districts, medical officers should insist that troops be supplied with these articles. The mosquito bar now issued can be used either on the bunk or in the shelter tent, and in malarial districts the troops should be ordered to carry them in the field, and compelled to use them in the shelter tents.

NOTES ON TRANSMISSIBLE DISEASES.

REPORTS OF EPIDEMIC DISEASES (MANUAL OF MEDICAL DEPARTMENT).

On the appearance of the first recognized case of typhoid fever, paratyphoid fever, smallpox, measles, diphtheria, cerebrospinal meningitis, or other epidemic disease at or near a military post or station the senior medical officer will at once report the same, and the nature and extent of the epidemic, as far as it has developed, to the commanding officer, sending at the same time a duplicate report direct to the department surgeon and a triplicate direct to the Surgeon-General. Should the outbreak occur in a command *en route* to a new station, whether by marching, by rail, or by water, the medical officer will make a similar report in triplicate, and will in addition send a quadruplicate direct to the surgeon of the new station.

The continuance of the epidemic, its progress and decline, its origin or importation, the measures taken for its suppression, the number of cases, the number of deaths and recoveries, and such other information in relation thereto as may be important and interesting will be noted from month to month in the sanitary reports (form 50).

The senior medical officer of a military post will promptly notify the local board of health, if there is one, of all cases of infectious disease occurring at the post of which such board would take cognizance were the same to occur in the community subject to its supervision.

THE SOURCES AND MODES OF INFECTION.[1]

I. LIFE OF DISEASE GERMS OUTSIDE THE BODY.—While it is possible that anthrax, tetanus, and pus organisms may develop in the soil, there is no evidence that they commonly do so. Typhoid, cholera, dysentery, and plague may maintain a limited saprophytic existence, but this is probably quite unusual. In temperate climates, such a source for these diseases must be an almost infinitesimal factor in their development. Probably the diphtheria bacillus never has a saprophytic growth of any significance, except possibly very rarely in milk. As for tuberculosis, pneumonia, influenza, meningitis, scarlet fever, typhus, smallpox, whooping-cough, gonorrhea and syphilis, malaria, yellow fever, etc., there is not the slightest reason for supposing that they ever develop outside the bodies of animals. These facts all point toward the relative importance of human agencies in the spread of disease, and of insect transmission, and toward the relative unimportance of fomites in the transmission of disease.

II. CARRIERS AND MISSED CASES.—1. Mild atypical and unrecognized cases of the infectious diseases are often extremely common. In many diseases they may be more numerous than the recognized cases.

2. Disease-producing microörganisms, whether bacteria or protozoa, frequently persist in the body without causing symptoms.

3. These germs may remain for weeks, months, years, or for life. Sometimes these carriers give no history of ever having been sick.

4. While the bacteria found in carriers may be avirulent, they are often very virulent.

5. There is ample epidemiological evidence that healthy carriers as well as mild, unrecognized cases are the source of well-marked outbreaks.

[1] Chapin, 1910, Wiley and Sons.

6. The number of carriers varies greatly in different diseases. From 20 to 50 per cent. of the population are carriers of the pneumococcus. During outbreaks of cerebrospinal meningitis the number of carriers may be from ten to thirty times as numerous as the number of cases. Even when diphtheria is not prevalent, 1 per cent. of the population may be carrying the bacilli, and during epidemics the number may be several times higher. Probably 25 per cent. of all typhoid fever cases excrete bacilli for some weeks after convalescence, and it is estimated that from 1 in 500 to 1 in 250 of the population are chronic carriers. They are probably as numerous in cholera and dysentery. In malaria carriers are particularly numerous, but there is no evidence that there are many carriers of measles or smallpox.

7. Any scheme of prevention which fails to take into account carriers and missed cases, is doomed to partial and perhaps to complete failure.

III. Limitations to the Value of Isolation.—1. Isolation of known cases will be of little preventive value if the still more numerous missed cases and carriers are permitted to be at large. Isolation has been a failure in most cities for such diseases as diphtheria, measles, and scarlet fever for this reason. (It is probable that with men under military control and with an efficient sanitary service and diagnostic laboratory facilities, better results may be secured by isolation in the army.)

2. The danger to be apprehended from a single infected person is much less than has been supposed.

3. Isolation is of far less value than was believed a few years ago.

4. The fewer the number of infected persons in a community or institution the more likely is isolation to be successful. Isolation in an extensive outbreak rarely accomplishes much. The effectiveness of isolation varies inversely as to the number of missed cases and carriers.

5. Hospitalization in such diseases as scarlet fever and diphtheria cannot be expected to exterminate them, and many patients can be as well cared for in their homes.

6. In diphtheria, scarlet fever, and measles there is rarely and only in certain occupations, any necessity for interfering with the wage-earners of the family.

7. The isolation of school-children should be more strict than that of adults, for less hardship results, and there is more danger in the mingling of children than in the intercourse of adults.

IV. INFECTION BY CONTACT.—This is the most obvious mode of transmission of many of the infectious diseases. Venereal diseases are all conveyed by contact, either direct or indirect. Typhoid is frequently a contact infection, especially among soldiers, and the same is undoubtedly true of cholera and dysentery. Contact infection is especially dangerous because of carriers and missed cases. The danger from saliva is especially great. The fingers are frequently brought in contact with the mouth and nose, and if infection is present it is conveyed to all objects and people subsequently touched. One shakes hands with a man having a cold, and then perhaps licks a postage stamp, and then we wonder from whom we contracted the cold. The methods of direct or indirect contact are infinite, and most infectious diseases are conveyed in this way.

V. INFECTION BY FOMITES.—1. There is no good epidemiological evidence that any diseases except those due to spore-bearing bacteria are to any great extent transmitted by fomites.

2. Judging from our experience with yellow fever, most of the alleged evidence of infection by fomites is not to be relied upon.

3. Even if all the alleged fomites infection is real, only a very small part of contagious disease is traceable to this source.

4. The theory of fomites infection was an *a priori* not an *a posteriori* theory, and is no longer demanded to explain the facts.

5. Other modes of transmission account for the spread of disease so much more satisfactorily that there seems to be really little opportunity for infection by fomites.

6. Laboratory investigation shows that fomites infection with spore-bearing bacteria is common; that such infection in typhoid fever, tuberculosis, diphtheria, and with other resistant organisms doubtless sometimes takes place; that it is possible in cholera and plague, while such infection in gonorrhea, influenza, meningitis, and pneumonia must be practically impossible.

7. Fomites infection is impossible in yellow fever, malaria, and other insect-borne diseases. Finally, it may be affirmed that fomites infection is of very much less importance than was formerly believed. (It naturally follows that terminal disinfection is of very much less importance than was formerly believed, and that it is useless in diseases that cannot be spread by fomites.)

VI. INFECTION BY THE AIR.—1. The theory of aerial transmission of disease was developed as the most reasonable way of explaining the method of transmission, but contact infection with carriers and missed cases affords a better explanation of the phenomena, and the best medical thought has been steadily restricting the supposed sphere of aerial transmission. Only a few authorities now assert that disease is carried by the atmosphere outside of dwellings, and this assertion is only made with regard to smallpox.

2. Bacteriology teaches that most diseases are not likely to be dust-borne, and they are spray-borne only for two or three feet, a phenomenon which resembles contact infection more than aerial infection as ordinarily understood. Tuberculosis is the only common disease that is likely to be air-borne.

3. There is considerable evidence that scarlet fever, diphtheria, smallpox, measles, whooping-cough, typhoid fever, and plague are not easily transmissible through the air.

4. Scarlet fever and diphtheria can be cared for in the same ward with other diseases without extension if surgical cleanliness be maintained, and infection by contact avoided.

DISINFECTION AND DISINFECTANTS.

TERMINAL DISINFECTION.—The value of terminal disinfection has been greatly overestimated in the past when it was believed that most diseases could be transmitted by fomites. It is now generally recognized that most diseases are spread by people rather than by objects, and that terminal disinfection will be useless in such diseases as measles, whooping-cough, influenza, pneumonia, cerebrospinal meningitis, diphtheria, typhus, etc.

In the case of diseases of unknown etiology, such as smallpox, terminal disinfection may be valuable, and is very generally employed on the principle of taking no chances. In the military service and elsewhere formaldehyde gas is very extensively used for this purpose. For generating this gas, 1 pint of formaldehyde solution and 1 pound of potassium permanganate and $\frac{1}{2}$ pint of water should be mixed in a deep container (*e. g.*, a close stool). This quantity is adequate for 1000 cubic feet of air space, and the necessary articles are all carried on the supply table.

DISINFECTION OF BEDDING AND CLOTHING.—Should there be no fecal or other stains, such articles may be immersed in boiling water. Should they be stained, they may be soaked in solutions of phenol, one of the cresols, or formalin of 5 per cent. strength. Such treatment is usually only necessary after the intestinal diseases, such as typhoid, cholera, and dysentery. Outer clothing may be disinfected with formaldehyde gas should this be necessary. The destruction of clothing or bedding is practically never necessary. (See Par. 230, M. M. D., 1916.)

SPUTUM.—In pneumonia, tuberculosis, influenza, and other conditions in which the sputum is infectious it may be received in spit cups partially filled with disinfectant and kept covered when not in use; 5 per cent. phenol, cresol, or formalin may be used. Bichloride solution should never be used to disinfect albuminous matter.

FECES.—The bowel discharges in typhoid, dysentery, cholera, intestinal tuberculosis and other infectious intestinal diseases should be received in vessels containing an amount of disinfectant solution somewhat larger than the probable volume of the excreta, and sufficient to entirely cover it if solid. Milk of lime and chlorinated lime are efficient. Phenol, cresols, or formalin may be used in 5 per cent. solutions. Should none of these be obtainable the stool may be disinfected after deposition by filling the bed-pan with boiling water. In any case the stool should be thoroughly mixed with the disinfectant and allowed to stand for some time.

PINE OIL.—Has been recommended as a disinfectant. Heat in a covered enamel pail, 1000 grams of pine oil with 400 grams of pulverized resin until dissolved. Cool to 80° C. and add 25 ounces of a 25 per cent. solution of sodium hydroxide and agitate thoroughly for ten minutes with a Dover egg beater. Add water sufficient to bring the mixture up to its original weight and cool by placing the pail in ice-water. The resin used is strained grade E, which formerly cost $2\frac{1}{2}$ cents a pound. The pine oil formerly cost from 40 to 50 cents a gallon, so that the total cost of this mixture was about 50 cents a gallon. It is understood that since the war the prices of these articles have risen so that it is no longer cheaper than other antiseptics; at the same time since phenol and cresols are almost prohibitive in price the above formula may be useful.

ANIMALS CONCERNED IN DISEASE TRANSMISSION.

HUMAN DISEASES ARE CARRIED:

1. *By the Dog:*
   - Rabies.
   - Foot-and-mouth disease.
   - Helminthiasis.
     - Flukes.
     - Tapeworms (especially Tenia echinococcus).
   - Infantile splenomegaly (from dogs through fleas).
2. *By the Cow:*
   - Tuberculosis.
   - Actinomycosis.
   - Anthrax.
   - Cow-pox.
   - Tetanus (through vaccine).
   - Foot-and-mouth disease.
   - Septic sore throat (streptococci in milk of cows suffering from mastitis).
   - Rabies (rare).
   - Tenia saginata.
3. *By the Horse:*
   - Glanders.
   - Rabies (rare).
   - Tetanus.
   - Sporotrichosis.
   - Anaphylaxis.
     - Serum sickness, acute anaphylaxis after use of antitoxins, odor of horses.
4. *By Swine:*
   - Trichiniasis.
   - Tenia solium.
   - Tuberculosis (rare).
5. *By Sheep:*
   - Anthrax.

HUMAN DISEASES ARE CARRIED (*Continued*):

6. *By Goats:*
   Malta fever.
7. *By the Antelope:*
   Sleeping sickness (the antelopes are the natural reservoir of the T. Gambiense).
8. *By the Cat:*
   Rabies.
   Cestodes.
   Trematodes.
9. *By Rats:*
   Bubonic plague (through fleas).
   Trichiniasis (through hogs to man).
   Rat-bite fever.
10. *By Ground Squirrels:*
    Bubonic plague.
11. *By Birds:*
    Psittacosis (from parrots).
12. *By Fish:*
    Cestodes (Bothriocephalus latus).
13. *By Arthropods, chiefly Insects:*
    Ticks and Mites:
    Rocky Mountain spotted fever (Dermacentor venustis the transmitter).
    African relapsing fever (Ornithodorus moubata the transmitter of S. duttoni).
    Japanese Tstutsugamushi fever (A mite, Trombidium is the transmitter).
    Mosquitoes:
    Yellow fever.
    Malaria.
    Filariasis.
    Dengue.
    By Fleas:
    Bubonic plague.
    Infantile splenomegaly.

HUMAN DISEASES ARE CARRIED (*Continued*):

By Lice:
- Typhus fever (P. vestimenti the usual transmitter).
- European relapsing fever (Spirocheta obermeieri).

By Bed-bugs:
- Kala azar (probably).
- European relapsing fever.

By Flies:
- Sandfly fever or Pappataci fever (transmitted by the phlebotomus).
- Sleeping sickness or trypanosomiasis (transmitted by Glossina palpalis).
- Typhoid and other infections (by Musca domestica, mechanically).

By Crustaceans:
- Guinea worm or dracunculosis transmitted by the cyclops.

By Mollusks:
- Typhoid fever transmitted by oysters, clams, etc.
- Trematode infections, particularly schistosomiasis, transmitted by snails.

CEREBROSPINAL MENINGITIS.

This disease occurs in sporadic and epidemic form, usually in the winter and spring. The concentration of young men in barracks is a special factor in the development of the disease, because recruits and young soldiers have always been especially susceptible, and many epidemics have occurred among troops.

ETIOLOGY.—The Diplococcus intracellularis or Meningococcus. There are several types of this organism which are culturally identical, but may be distinguished by their agglutination reactions.

Method of Transmission.—The disease is not highly contagious and is not transmitted by clothing or fomites, since

the meningococcus has not been found outside the human body but is probably spread by contact with cases of the disease or with carriers who in turn have been in contact with a case. The meningococcus is found in the nasopharynx of cases of the disease and of carriers, and the carriers practically always harbor the same type of the organism as that found in the case with which they have been in contact. It is believed that the organism gains entrance to the system through the mucous membrane of the nasopharynx, and that the infection is spread through contact transference of the discharges and secretions from the mouth and nose. The carriers of the disease may be many times more numerous than the recognized cases.

INCUBATION PERIOD.—This is not known with certainty, owing to the fact that it is usually impossible to tell when the infection was acquired.

SANITARY MEASURES.—If prompt measures are taken as soon as a case appears to identify and isolate contacts, there may be no further spread of the disease. If such measures are deferred until a number of cases have occurred, or should the first steps prove ineffective, the situation becomes much more difficult because of the very large number of contacts. It is impracticable to isolate so many men, most of whom are not infected, so that if anything is to be done an examination of the contacts must be made to detect carriers. This work can only be done by a diagnostic laboratory working on the spot. Swabs and throat cultures of the meningococcus cannot be mailed to a department laboratory because the organism will not usually live under such circumstances. In view of the above facts, when a case appears in camp the following measures should be taken:

1. *Prompt Diagnosis.*—Lumbar puncture should be made early in a suspected case. The fluid withdrawn is generally purulent in positive cases, but in any case stained smears should be examined. Löffler's methylene blue and Gram's

stain may be used. Should there be numerous pus cells containing biscuit-shaped Gram-negative diplococci which closely simulate the appearance of the gonococcus a positive diagnosis may be made. The pneumococcus is not infrequently the cause of cases of meningitis, but these cases are sporadic, not epidemic. The pneumococcus may be distinguished by the fact that it is Gram-positive and is lanceolate rather than biscuit-shaped, and is not found so frequently in the leukocytes. Camp hospitals should be equipped to make these simple stains, and may also, if practicable, make cultures from the fluid on blood serum or blood agar. Early diagnosis is important, as it enables steps to be taken promptly to isolate contacts and possible carriers.

2. *Isolation of Contacts.*—All the men in the same tent or room may be considered to be contacts, together with any other men with whom the patient has been intimate. When a case has occurred it is quite usual to find that several men in the same squad room are infected and will either develop the disease or become healthy carriers. These men should be placed in a detention ward and watched until all danger of an epidemic is past or until swabs have shown the absence of meningococci in the nasopharynx.

3. Isolate the patient in a separate room in the hospital and disinfect the secretions from the mouth and nose. A carbolic mouth wash and an antiseptic spray for the nose may be used. Physicians and attendants should take measures to avoid transference of infection to their own throats and noses, including washing the hands immediately after attending to the patient. The nasal secretions of the patient may be received into pieces of gauze, which should be promptly burned.

II. Should secondary cases appear, or should circumstances be such that an epidemic is feared, request should be made to the chief surgeon by telegraph for a field laboratory. With laboratory work performed on the ground the following steps may be taken:

1. Cultures from both spinal fluid and nasopharynx of cases to determine the type of organism.

2. Examination of the nasopharynx of all contacts to detect carriers. This may be done by means of swabs, which should be plated at once as soon as the swab is taken, and the single colonies that develop can be tested in about twenty-four hours with immune serum to determine not only whether the meningococcus is present but also to determine the type. If the type of organism found in the contacts is the same as that found in the patient, no other source of infection need be suspected. However, should types be found other than those found in the patient, other carriers must be present and should be searched for. This may be done by examining the contacts of the contacts. This necessarily entails a large amount of work, as during an epidemic 10 per cent. of the men may be carriers.

3. All carriers to be isolated until negative swabs can be obtained. All men not carriers to be released at once.

4. Treatment of carriers to remove infective organisms. A carbolic mouth wash may be used with antiseptic sprays. Various nasal sprays have been used, including Dobell's solution, iodin and menthol, chlorin water (potassium chlorate 10 grains, strong HCl 2 drops, water to 1 ounce), and chloramin solution 1 to 2 per cent. Chloramin appeared to be the most useful form of spray in one set of observations, but it cannot be said that any of them was especially efficacious.

Inhalations.—Kuster (*Deutsch. med. Wchnschr.*, September 1, 1915) states that early in 1915 a few cases of cerebrospinal meningitis occurred among the troops at Cologne, and an investigation showed that from 50 to 60 per cent. of the men were carriers. As there was little prospect of sterilizing these men by individual treatment, they were treated in an inhalatorium, 100 men at a time. The disinfectant used contained a hypochlorite which gave off chlorine on contact with acids.

Meningococci exposed to the action of this disinfectant were killed within an hour. After three visits to the inhalatorium on three successive days the carriers were no longer found to harbor meningococci. Although the inhalatorium smelt strongly of chlorin, no ill effects were observed. It was also claimed that the same results were obtained with diphtheria carriers. The observation is given for what it may be worth, and as other processes have been disappointing it may be worthy of a trial.

III. *Genereal Measures.*—Take steps to prevent overcrowding, and to educate soldiers to avoid contact infection. (See note on Overcrowding and Contact Infection.)

CHOLERA.

ETIOLOGY.—Spirillum choleræ asiaticæ.

Method of Transmission.—The organisms from the excreta or vomitus of a previous case must be swallowed. Cholera may be transmitted by means of infected water supplies, by infected food, or by direct contact with a case of the disease or with carriers. As in the case of typhoid, flies may carry the organism from the excreta to the food. In later years carriers have assumed great importance. In Germany, in 1905, of those persons placed under observation, from 5 to 12 per cent. were carriers; in Manila, in 1908, about 7 per cent. were found. Convalescents or carriers have been demonstrated to harbor the spirillum in the stools for from ten to sixty-nine days. Gaffky reported one case who was a carrier for six months, and another observer reported that in two cases spirilli reappeared in the stools after a negative period of twenty days and one month respectively. These long-time carriers make a farce of the usual five-day quarantine without stool examination.

INCUBATION PERIOD.—Usually two to five days. (Osler.)

PROPHYLAXIS AND CONTROL.—I. *General Measures.*—1. *The Provision of Pure Food and Drink.*—The water supply

must be above suspicion or must be purified. Milk should be pasteurized or canned. During an epidemic food should be served hot on hot plates, and no raw vegetables should be eaten, particularly in countries where human excreta is used for fertilizer. The skins of fruits that are to be eaten raw should be washed off with a disinfectant solution (phenol 1 to 2 per cent.).

2. *A Sanitary and Satisfactory Disposition of all Excreta.*—Access of flies to excreta must be absolutely prevented, and excreta must be so disposed of that contamination of water is impossible.

3. *Prevention of Contact Infection from Soiled Hands.*—All persons in the military service should be compelled to wash the hands after leaving the rear, and all persons not in the military service should be educated to do the same. Cholera in Bilibid prison was probably caused by carriers, and was suppressed by an order compelling disinfection of the hands under guard after leaving the latrines and before eating.

4. *Prevention of Fly Transmission.*—Measures must be taken to eradicate flies (see Flies), to screen kitchens and mess halls, and to prevent all access of flies to either excreta or food.

II. *Specific Measures.*—1. *Measures to Secure Prompt Notification of All New Cases.*—When dealing with native races it may be assumed that notification cannot be enforced. Here a medical certificate as to the cause of death must be required before a permit for burial is issued, and all suspicious cases must be subjected to postmortem examination.

2. *Prompt Isolation of Cases or Suspected Cases in Hospital.*—Cholera wards or rooms to be fly-proof and measures to be taken to disinfect all stools and vomitus and to prevent infection of nurses and attendants. Nurses should disinfect the hands after handling patients, and cultivate the habit of keeping the fingers away from the mouth.

3. All contacts to be isolated in small groups in a detention camp for five days. If they do not develop cholera a stool

examination must be made to detect carriers. All not found to be carriers may be released at the end of five days.

4. All convalescent cases of the disease and carriers to be detained until three successive negative stool reports at intervals of a week apart can be obtained.

III. *Vaccination.*—Should cholera appear among troops they should all be given a prophylactic dose of cholera vaccine which may be prepared in the same manner as typhoid vaccine. The evidence indicates that this vaccine affords a high degree of protection for several months at least.

IV. *Quarantine.*—Quarantine regulations of the United States state that for the purpose of these regulations five days shall be considered as the incubation period of cholera.

All ships arriving under five days from cholera-infected ports or that have had cases of cholera on board must be detained for this period. Carefully isolate those especially suspected (contacts), and segregate the remainder of the passengers in small groups. Stool examinations should be made in all cases to detect carriers.

Method of Stool Examination.—By the following method one person may examine from 100 to 150 stools per day, a report being obtainable, as a rule, in twenty-four hours. Inoculate enriching peptone solution as soon as the stool is secured, if possible in the morning. Make agar plates at night and examine the colonies the following morning. A macroscopic agglutination test is performed on all suspicious colonies on a glass slide in the following manner: Place a loopful of physiological salt solution on the slide and emulsify the suspicious colony in it. Add one loopful of a strong cholera-immune serum (agglutination 1 to 5000 or higher) in a dilution of 1 to 100. This makes the dilution on the slide 1 to 200. In this dilution cholera vibrios are immediately agglutinated. The agglutinated colonies may be identified further by cultural methods later, but for sanitary purposes all cases in which vibrios are found giving a positive agglutination should be detained as carriers. All negative cases may be released.

COLDS.

The common cold is the cause of much suffering and disability and in addition is a predisposing cause of many other infectious diseases including tuberculosis and pneumonia. It probably causes more loss of efficiency than any of the acute infectious diseases. For these reasons an endeavor should be made to limit the spread of this disease as much as possible.

ETIOLOGY.—Many organisms have been incriminated including streptococci, the pneumococcus, micrococcus catarrhalis, and the B. rhinitis of Tunnicliff. Recent work by Captain George B. Foster indicates that these organisms are secondary invaders, and that the real cause is a filtrable virus.

Method of Transmission.—The common cold is highly infectious, and when one individual in a house or tent develops the disease, secondary cases are frequent. The virus is present in the nasal secretion and probably in the buccal secretions, and is conveyed to the nose or throat of healthy individuals by means of the droplets expelled during coughing and sneezing, and also by direct contact. The fingers of the patient are probably constantly infected. Exposure to cold and sudden changes of temperature are undoubtedly predisposing causes.

PERIOD OF INCUBATION.—In experimental cases this ranged from six to thirty hours.

PROPHYLAXIS.—I. *General Measures.*—1. Prevention of overcrowding and measures to avoid contact infection. Education of the men by means of posters or other methods, so that those infected will be careful to protect others from the infectious droplets by the proper use of handkerchiefs. If handkerchiefs are not available, pieces of gauze may be used and subsequently burned.

2. Protection of the men from extremes and great variations in temperature as far as possible. This entails the issue of clothing adapted to the climatic conditions, and some

oversight on the part of surgeons and company officers to see that the proper clothing is actually worn. If such clothing is not available, mention of the fact should be made in the regular or a special sanitary report.

II. *Specific Measures.*—1. When possible isolate by treating the man in bed in the hospital. This will not only be better for him, but will prevent the general dissemination of the condition throughout the command.

2. When this is not possible, at least begin treatment promptly. Local treatment of the nose with thorough douching and cleansing does not cure, but it does relieve the symptoms so that sneezing and coughing will be much reduced. This reduces the danger of disseminating the disease very materially.

DENGUE.

Dengue is practically never fatal, but it generally occurs in widespread epidemics, and as the disease incapacitates a man completely for from one to two weeks, it is frequently the cause of much loss of efficiency. Epidemics are frequent among troops in the Philippines, and the disease is common in Texas, Mexico, Cuba, Puerto Rico, Panama and other countries where our troops may serve.

ETIOLOGY.—A filterable virus at present unknown.

Method of Transmission.—The blood of the patient is infectious, and the disease is undoubtedly transmitted by the bites of infected mosquitoes. The experiments of Ashburn and Craig indicated Culex fatigans as the transmitter, while experiments by English observers have incriminated Stegomyia fasciata. Both of these mosquitoes must therefore be suspected, although it is probable that only one of them is the actual transmitter.

PROPHYLAXIS.—(See Mosquitoes.)

1. Screen all patients to prevent mosquitoes from becoming infected.

2. A campaign against mosquitoes.

3. The use of screening, mosquito bars, and other measures to prevent healthy individuals from being bitten.

DIPHTHERIA.

ETIOLOGY.—B. diphtheriæ (Klebs-Loeffler bacillus).

Method of Transmission.—The organism may rarely be present in milk, but aside from this has no independent existence in nature. Infection must be received from some person who carries the bacilli in the throat or nose, and who may be either a clinical case of the disease or a carrier. As most of the marked cases of diphtheria are isolated, the spread of diphtheria is due almost exclusively to mild missed cases of the disease, and to carriers.

Susceptible Age.—Schick tests have indicated that 80 per cent. of the newborn contain sufficient antitoxin to protect, but that this number rapidly decreases, so that the period of greatest susceptibility is from the end of the first year to the end of the fifth year, during which time from 50 to 60 per cent. of children contain sufficient antitoxin in the blood to be immune. After this period the percentage gradually rises until among adults 90 per cent. are immune. From this it will be seen that while diphtheria may occur among soldiers it is not apt to become epidemic. The measures outlined below will generally eradicate the disease, and will at least limit its spread.

INCUBATION PERIOD.—Two to seven days, oftenest two. (Osler.)

CONTROL.—To be successful, sanitary work must be carried out with the close coöperation of a diagnostic laboratory. The diagnosis of the disease is based upon the finding of bacilli in the throat or nose which are morphologically diphtheria. When a case of diphtheria occurs in an organization the following steps may be taken:

1. Take a nose and throat culture on blood serum from each man in the organization. This is to detect developing cases and carriers.

2. Perform the Schick test on all men of the organization. This is to determine which men are susceptible to diphtheria.

3. When the report from the laboratory is received, isolate all men whose cultures show bacilli that are morphologically diphtheria.

4. Give a prophylactic dose of antitoxin (1000 units) to those who have been in contact with a recognized case of the disease, and who have a positive Schick test.

Generally speaking, 30 to 80 per cent. of cultures of bacilli from carriers who have not had diphtheria and have not been exposed to a case are non-virulent. On the other hand, bacilli from persons who have had diphtheria, or have been intimately exposed to the disease, are virulent in from 61 to 100 per cent. of the cases. In the management of such carriers a virulence test becomes necessary, as it is useless and very troublesome to isolate men who harbor avirulent bacilli. The following test is recommended.

Virulence Test.—Pure cultures of the organism are grown for twenty-four hours on slants of Loeffler's blood serum in usual sized tubes; 10 c.c. sterile salt solution is used to wash off each tube and an even emulsion secured; 4 c.c. of this emulsion is injected subcutaneously in the median abdominal line of a guinea-pig of 250 to 300 grams weight. Watch carefully for four days for evidences of local edema and general intoxication. If the culture has no effect at all on the guinea-pig, it is avirulent, and cannot produce diphtheria.

Rules for the Management of Carriers.—1. Carriers having avirulent organisms as shown by a proper virulence test on guinea-pigs may be released from isolation.

2. Should the virulence test be impracticable the carrier may be released should the Schick test be positive. A positive test means that the patient is susceptible to diphtheria,

and as he has not diphtheria, the deduction is drawn that the organisms in his throat are avirulent.

3. All carriers having virulent organisms and all patients recovering from diphtheria must be isolated in hospital until at least three successive negative cultures from both nose and throat can be secured. Cultures should be taken every other day.

Comment.—The rigid isolation of all diphtheria carriers in civil life is probably impracticable nor is it necessary. Isolation has generally failed to control the disease in cities because it is impossible to control all the carriers, and it does no good to isolate a small percentage of the carriers while allowing the others to go free. Moreover, a carrier would be of little danger to the community if he avoided close contact and always coughed or sneezed into a handkerchief instead of into the surrounding atmosphere. However, conditions are different in the military service. When men are crowded in tents or barracks, or perhaps sleeping side by side, close contact cannot be avoided. Moreover, with men under military discipline all the carriers can be isolated, so that under these circumstances isolation is more necessary than is the case in civil life, and the chances that it will be made effective are much better.

Treatment of Carriers.—There is no satisfactory method of treating carriers to remove the diphtheria bacilli from the nose and throat. Kaolin, yeast, and staphylococcus sprays have all been tried and found wanting. By the use of these methods, negative cultures may be secured while the bacilli are still present, the latter being merely covered up. Painting the throat with silver nitrate solutions is of dubious value. Probably a simple antiseptic nasal spray and gargle will remove the offending organisms as rapidly as any other method.

Duration of Passive Immunity.—The duration of immunity following the prophylactic injections of antitoxin varies

between twenty-one to twenty-five days, as shown by the Schick test. In 108 children studied who received 1250 units of antitoxin, it was determined that this amount conferred efficient immunity for ten days; but that after this interval the antitoxin rapidly disappeared, so that after four to six weeks the immunity had entirely disappeared.

The Schick Test.—A fresh solution of diphtheria toxin is prepared of such strength that 0.2 c.c. represents $\frac{1}{50}$ of the minimum lethal dose of toxin for a 250-gram guinea-pig. This amount is injected with a good syringe and a fine needle *intracutaneously* on the flexor surface of the forearm. A properly made injection is recognized by a distinct wheal-like elevation. The result of the test should be read at the end of twenty-four, forty-eight, seventy-two and ninety-six hours.

The reaction that appears at the site of injection may be either positive, negative, pseudo, or combined positive and pseudo.

The positive reaction represents the action of an irritant toxin upon cells that are not protected by antitoxin and indicates an absence of immunity to diphtheria. A trace of redness appears slowly at the site of injection in from twelve to twenty-four hours, and is usually a distinct reaction in the course of twenty-four to forty-eight hours. The reaction reaches its height on the third or fourth day and gradually disappears, leaving a definitely circumscribed scaling area of brownish pigmentation which persists for three to six weeks. At its height the positive reaction consists of a circumscribed area of redness and slight infiltration which measures from 1 to 2 cm. in diameter.

The Negative Reaction.—The skin at the site of injection remains normal. The negative reaction definitely indicates an immunity to diphtheria if the test toxin is of full strength and the injection has been properly made. A negative reaction obtained after the age of three years indicates an immu-

nity that is probably permanent. Of 1000 carefully observed individuals no one developed clinical diphtheria, even though they were exposed to the disease, and some were carriers of virulent diphtheria bacilli.

The pseudoreaction represents a local anaphylactic response of the cells to a protein substance. Like other anaphylactic skin phenomena the reaction is of an urticarial nature, appears early, within six to eighteen hours, reaches its height in thirty-six to forty-eight hours, and disappears on the third or fourth day, leaving a poorly defined small area of brownish pigmentation and generally no scaling. At its height it shows varying degrees of infiltration, and appears as a small central area of dusky redness with a secondary areola, which gradually fades off into the surrounding skin. The reaction may also have a rather uniform red appearance and be two or three times the size of a true reaction. A control test, made by injecting toxin heated to 75° C. for five minutes, gives a similar reaction which passes through the same clinical course. Individuals who give a pseudoreaction only have antitoxin and are immune to diphtheria. The false reaction is seen in relatively few of the older children, but in a much larger number of adults, in whom it is of importance to recognize and control it both by the injection of heated toxin and by observing the clinical course of the reaction.

The toxin for the performance of the Schick reaction may be obtained through the Department Laboratories.

AMEBIC DYSENTERY.

ETIOLOGY.—Endameba histolytica. The cysts of this organism are the infecting agent, the motile forms being destroyed by external agencies and the gastric juice.

Method of Transmission.—The cysts reach the intestine of man by ingestion of material containing cysts, usually contaminated food or drink. Contamination may occur by

direct infection from soiled fingers (carriers), by flies that have been in contact with the excreta of infected individuals, through the improper disposal of sewage which gains access to food or drink, and by the use of human excrement as fertilizer, and by dust blowing about, and which may contain cysts from dried and pulverized feces. This latter method is not important.

Life of Cysts Outside the Body.—Cysts remain unchanged in water for a period of at least twenty-five days. In solid stools they remain unchanged for a month in portions that retain some moisture. When exposed to sunlight the cysts dry so that transmission through dust is exceptional. Cysts may be found in an unchanged condition in the intestine and excreta of flies as long as eighteen hours after these insects have fed upon material containing them.

Carriers.—Many, perhaps the majority, of patients who have had amebic dysentery continue to pass cysts in the stools after a clinical cure by emetine or other treatment. In addition to this, some persons may pass cysts in the stools, although they have not had clinical dysentery. Carriers of this infection must therefore be fairly numerous. The length of time a person may be a carrier is not known, but it is known that a patient may continue to pass the cysts for at least a year. It is probable that the main sources of this infection among soldiers are carriers and flies.

Period of Incubation.—Walker fed 20 men material containing cysts of E. histolytica; 18 became parasitized, the average time of appearance of endamebæ in the stools being six days. Of these cases 4 developed typical amebic dysentery, 1 after twenty days, 1 after fifty-seven days, 1 after eighty-seven days, and 1 after ninety-five days, the average being sixty-five days. Craig analyzed 156 cases on the Mexican border and found that 35 per cent. developed the disease within one month after arrival, 65 per cent. within two months, and 90 per cent. within three months.

PROPHYLAXIS.—I. *Carriers.*—1. When a case of this disease is discovered a microscopic examination of the stools of all soldiers who are concerned with the preparation of food or drink should be made at once. If possible this examination may include all members of the organization. A field laboratory may be sent to assist in diagnosis and sanitary control of this disease.

2. If carriers are detected, they should be admitted to hospital and treated. Treatment with emetine bismuth iodide is said to remove cysts from carriers. Ordinary emetine treatment is apt to be unsuccessful. Walker and Emrich in a recent article (*Jour. Am. Med. Assn.*, 1917, p. 1456) recommend oil of chenopodium.[1] If the carrier cannot be cured, he should be discharged.

3. Elimination of carriers by thorough treatment of existing cases controlled by microscopic examination prior to discharge from hospital. No case to be returned to duty who is a carrier.

II. *General Measures.*—1. Thorough and rapid disposal of all feces. Whatever method be adopted, it must be so managed that the water supply cannot become contaminated, and that flies cannot gain entrance to the feces in the latrine. All members of the command to wash their hands after leaving the latrine.

2. Fly screening and destruction of flies. (See Flies.)

3. Provision of a good water supply.

4. Hospitals should be fly-screened. Disinfect all clothing soiled by dysenteric discharges. Disinfect excreta immediately after passage, disinfect bed-pans, and be sure they are kept closed so that flies cannot gain access to them.

5. In countries where human excreta are used for fertilizer, eat no uncooked vegetables.

[1] 16 to 48 minims following free purgation with mag. sulph. They claim that this may remove all amebæ, and this treatment should be given a trial.

6. Do not eat or drink in native quarters. If natives are used for cooks or mess attendants they should be examined to exclude carriers, and they should always be kept under the closest supervision and be compelled to wash the hands after leaving the rear.

7. Physicians should instruct the nurses caring for these cases as to the manner of spread of the disease, and should give the necessary orders to prevent their becoming infected.

BACILLARY DYSENTERY.

ETIOLOGY.—Bacillus dysenteriæ. This is a group of organisms rather than a single bacillus, but this is a scientific rather than a practical fact. All members of the dysentery group may produce bacillary dysentery. Infection with the Shiga type is apt to be particularly severe, while infection with the Flexner type is apt to be relatively less severe.

Method of Transmission.—The disease can only be acquired by swallowing bacilli from the excreta of a previous case. Bacillary dysentery is spread by precisely the same methods as is typhoid, namely, in contaminated food and drink, and particularly by contact with preëxisting cases or carriers; through the employment of carriers in the preparation of food and drink and by flies.

PERIOD OF INCUBATION.—According to the human experiment of Strong and Musgrave the incubation period is about forty-eight hours.

CONTROL.—1. The measures to be taken against dysentery are precisely the same as those against typhoid (see Typhoid), with the exception of vaccination. A satisfactory vaccine against dysentery has not yet been worked out.

2. When a case of dysentery occurs, stools should be sent to the nearest department laboratory following the same directions given in the circular concerning typhoid. It is imperative that the stools received by the laboratory should be as fresh as possible if the organisms are to be successfully isolated.

3. Should the department laboratory be too far away to receive stools promptly, and should it appear that the disease may become epidemic, the Chief Surgeon should be promptly notified in order that a field laboratory may be sent to work out the etiology of the disease on the ground, to detect carriers, and to assist in the control of the disease.

INFLUENZA.

ETIOLOGY.—Bacillus influenzæ.

Method of Transmission.—The bacilli are excreted in the nasal and buccal secretions and are conveyed to other persons by droplets expelled in sneezing and coughing and by direct contact. The fingers of the patient are probably constantly infected.

PERIOD OF INCUBATION.—One to four days, oftenest three or four days. (Osler.)

PROPHYLAXIS.—Practically the same as for common colds (see Colds), except that as the disease is much more serious, isolation should be compulsory instead of optional.

I. *General Measures.*

1. Prevention of overcrowding. (See note on Overcrowding.)

2. Protection of the men from extremes of temperature and other general hygienic measures to maintain good general health. (See Ventilation.)

II. *Specific Measures.*

1. *Notification.*—Influenza is a dangerous epidemic disease and should be reportable. When the attending surgeon meets with cases resembling influenza, he should notify the sanitary officer of the fact.

2. *Laboratory Diagnosis.*—Many cases of common colds are sufficiently severe to resemble influenza, and before reporting cases as influenza an attempt should be made to verify the diagnosis by isolating the B. influenzæ. This is not easy, as the organism will only grow in the presence of

hemoglobin, but a man familiar with bacteriological technic could carry out this procedure in the laboratory of the camp hospital. Blood-agar plates should be used, the surface being smeared with mucus collected by blowing the nose or expectorating in a sterile Petri dish.

3. Isolation of the patient in hospital.

4. If cases are few, contacts may be isolated in detention camps in small groups for four days. If influenza does not develop, they may be released. If cases are numerous, this procedure would be of little value.

MALARIA.

ETIOLOGY.—The disease is caused by the malarial plasmodia, of which there are three species: Plasmodium vivax (Tertian plasmodium), Plasmodium malariæ (Quartan plasmodium), and Plasmodium falciparum (Estivo-autumnal plasmodium).

Method of Transmission.—Malaria is transmitted solely by the bite of certain of the mosquitoes belonging to the genus Anophelinæ, which have previously become infected by biting another patient having the sexual forms (gametocytes) of the parasite in the peripheral blood.

The malarial plasmodium undergoes a double cycle of development. The first is an asexual cycle called schizogony, during which multiplication occurs in the human red corpuscles, and the malarial paroxysm occurs at about the time this cycle is completed. After this process of asexual reproduction has lasted a certain length of time, some of these forms undergo a differentiation and become sexual forms (gametocytes). The sexual cycle goes no further in the human host. However, should these gametocytes be taken into the stomach of a suitable anopheline mosquito (it is important to notice here that the asexual forms cannot develop in the mosquito) the second, or sexual, cycle called sporogony is completed in the mosquito. The female or macrogametocyte

is fertilized by the male or microgametocyte, and the zygote so produced penetrates the cells of the mosquito's stomach, where it develops and forms a cyst. The nucleus of this cyst undergoes several successive multiplications, resulting in the formation of a large number of spores or sporozoites. The cyst finally ruptures and the sporozoites pass into the celom or general body cavity of the mosquito, and then easily find their way into the salivary glands which lie free in the celom. These sporozoites are then discharged with the saliva into any person that the mosquito subsequently bites, they enter the red corpuscles, and the human or asexual cycle is repeated. The cycle of development in the mosquito lasts from ten to twelve days. From these facts it will be seen that the continued propagation of malaria depends upon the following factors:

1. The presence of numerous human beings infected with gametocytes.

2. The presence of numerous anophelinæ in which these gametocytes may develop.

3. Free access of anophelinæ to infected human beings.

4. Free access of infected anophelinæ to other non-immune human beings. If this chain is broken at any point the propagation of the disease must cease. Corresponding to these divisions the following campaign against malaria may be mapped out.

I. *The Reduction of the Number of Infected Human Beings.*—If mosquitoes are exposed for any considerable length of time to a temperature below 65° F. plasmodia fail to develop in them, and those that have developed die. It is only in the extreme southern part of the United States and tropical countries generally in which the temperature does not drop below 65° F. For most of the United States therefore it may be safely stated that the length of time during which mosquitoes may serve as the hosts for the malarial plasmodium does not exceed four to six months. The disease would there-

fore become as extinct as the dodo were it not for the fact that during the other six to eight months the plasmodia are kept alive in human hosts who are malaria carriers and usually persons who have had malaria during the previous warm season. The great importance of the following measures is therefore apparent.

1. Early notification of all cases of malaria, with laboratory diagnosis giving the type of parasite.

2. If possible a survey of the population to detect carriers.

3. Efficient treatment of all cases, following each case with a malarial register. (Form 56, M. D.). If treatment is efficient the disease will not become latent, gametocytes will not be formed, and the case will not become a carrier capable of infecting mosquitoes.

The minimum treatment recommended is:

Quinin, grains xxx daily until symptoms are gone and plasmodia cannot be found; then

Quinin, grains xv daily for two weeks; then

Quinin, grains x daily for two weeks; then

Quinin, grains vi daily for at least two months.

II. *Measures to be Taken against Mosquitoes.*—(See Mosquitoes.)

1. Methods directed against the adult insect.

2. Methods directed against the larva.

3. Methods to prevent mosquitoes from biting.

Fortunately mosquito extermination is not necessary in order to prevent malaria; all that is necessary is to reduce the number of anophelinæ to such a point that the chain of infection will be broken. All of these measures must be combined with education of the command in order that co-operation instead of opposition may be secured.

PAPPATACI FEVER.

This disease is common in Austria, Italy and in countries bordering on the Mediterranean Sea. The disease is never

fatal, but like dengue causes great prostration and loss of efficiency in the military service.

ETIOLOGY.—The organism causing the disease is a filtrable virus at present unknown. The virus is present in the blood of patients during the first and second days of the disease but not later. After recovery the patient is immune to further attacks.

Method of Transmission.—Phlebotomus papatasii (sand fly) is the carrier of the disease. After feeding there is a period of from seven to ten days before the fly becomes capable of transmitting the disease, so that the virus must undergo a cycle of development in the fly. It is not known how long the fly remains infective, but probably for the rest of its life.

INCUBATION PERIOD.—In experimental cases this varied from three days, sixteen hours to seven days.

PROPHYLAXIS.—1. Screening of all patients especially during the first two days of the disease.

2. General use of screens to prevent the fly from biting.

3. Attempts to destroy the insect.

A campaign against the insect is difficult because of its peculiar life cycle. The fly lays its eggs in damp earth in the garden and particularly around old walls. The larvæ hatch out here, and it is very difficult to find and destroy them. Old walls may be torn down or may be repaired and the surfaces smoothed off with concrete.

Screening.—Ordinary mosquito bars and netting will not keep out the Phlebotomus which is a very small fly. Netting for this purpose should therefore be made of a cheap lawn or other suitable material with very fine meshes.

PNEUMONIA.

ETIOLOGY.—About 90 per cent. of all lobar pneumonias are due to the Diplococcus pneumoniæ or Pneumococcus of which there are four types that may be identified by their immunological reactions. The types of pneumococci with

the percentage of infections caused by each type together with the mortality, are indicated in the following table:

Type.	Percentage of cases.	Mortality percentage.
1. Pneumococcus, type I . .	30–47	About 24
2. Pneumococcus, type II .	18–39	" 60
3. Pneumococcus mucosus .	8–13	" 61
4. A group of independent varieties of pneumococci	20	" 7

Method of Transmission.—Pneumococci are commonly found in the mouths of healthy individuals, but investigation indicates that the pneumococci found in individuals that have not been exposed to cases of pneumonia all belong to class 4 comprising the heterogeneous organisms of low virulence. In persons who have been exposed to cases of pneumonia, the more virulent types are usually found, and the type found corresponds to the type of organisms infecting the case in question. After such an exposure the virulent type may persist in the sputum for a variable length of time, during which period the individual is a true carrier. Examination of the mouths of patients recovering from an attack of pneumonia has shown that they harbor the virulent type for from twelve to ninety days. We may conclude therefore that the majority and most fatal cases of pneumonia are dependent upon either direct or indirect contact with a previous case.

SANITARY MEASURES.—Pneumonia often occurs among soldiers, and under certain circumstances (overcrowding in barracks) the disease tends to become epidemic. As the disease is transmissible and has a high mortality, all possible precautions should be taken on the appearance of a case to prevent its spread.

I. *With Regard to the Cases of Pneumonia.*

1. Prompt notification just as with other infectious diseases.

2. Classification as to type of organism in the laboratory. Send the sputum to the nearest department laboratory.

3. Isolation of the case in hospital and the adoption of

antiseptic practises. The sputum must be disinfected as for tuberculosis. Physicians and nurses should wash their hands after handling cases of pneumonia and take all precautions to avoid transference of organisms to their mouths. Isolation of patient to continue as long as the patient continues to harbor the virulent type of pneumococcus. The sputum of convalescents may be sent once a week to the nearest department laboratory until a negative report is obtained, after which the patient may be returned to duty.

4. Whenever possible deal with the problem of carriers. The sputum of all contacts may be sent to the laboratory, and if virulent types of pneumococci are found, they may be isolated if thought desirable until a negative report can be obtained.

II. *General Measures.*

1. The prevention of overcrowding. (See Overcrowding.)

2. Education of the men to avoid contact infection. Cultivate the habit of keeping the fingers away from the mouth and nose and avoid contact with intermediate objects such as common drinking cups, handkerchiefs, towels, etc.

3. Take measures to reduce the amount of dust in camp. It is suspected that pneumonia may be carried by dust. It is probably not so transmitted, as the pneumococcus is a very delicate organism that cannot be expected to live long outside the body. But even if this is correct other diseases are carried by dust.

4. Increase the resistance or vital tone of the men by living a normal life so far as circumstances will permit. Sufficient food, sleep, exercise and clothing should be provided. Exposure and cold are predisposing causes.

MALTA FEVER.

ETIOLOGY.—The Micrococcus melitensis.

Method of Transmission.—Goats become infected and excrete the organism in the milk. The disease is usually

transmitted through the use of goats' milk, and although the organism is present in the stools of patients with the disease, and theoretically might be transmitted as is typhoid, this method of transmission is negligible except for physicians and nurses in close contact with such cases. The British troops at Malta had 240 cases per annum before 1906, but since 1906, when condensed milk only was supplied, the cases have steadily decreased, and in 1910 only 1 case was recorded.

INCUBATION PERIOD.—Six to ten days. (Osler.) Fourteen days. (Castellani and Chalmers.) The latter authors state that monkeys fed on infected milk developed the disease in fifteen days.

PREVALENCE.—The disease is known to exist in Texas, and probably in other localities in the United States. It should be suspected whenever goat's milk is known to be used.

PROHYPLAXIS.—Measures to be taken may be analyzed as follows:

I. *With Regard to the Patient.*

1. Prompt notification of all cases.

2. Isolate all cases, and as excreta are infective, disinfect as in a case of typhoid.

3. Convalescents may become carriers; do not discharge patient until excreta are free of M. melitensis.

4. In case of nursing mothers, as milk is infective, put child on the bottle.

II. *General.*

1. Avoid all use of goat's milk.

2. If goat's milk is used, it should be sterilized or at least boiled.

3. Since dust may carry infection, all goat corrals should be located at a proper distance from residences or habitations.

4. After handling goats, always wash hands before eating.

5. Good water supply and general hygiene.

III. *Veterinary Measures.*

1. An investigation of goats by serum and lacto-agglutination reactions or by blood or milk cultures to determine carriers.
2. Slaughter of infected goats.
3. Prevention of importation of infected animals.
4. Inspection and hygiene of stables.

MEASLES.

ETIOLOGY.—The causal organism has not yet been identified. The experiments of Anderson and Goldberger indicate that the virus of measles is filtrable. Their experiments on monkeys showed that the virus is contained in the blood, and in the buccal and nasal secretions, and that thirty-six hours after the appearance of the exanthem, the blood largely loses its infectivity. The experiments also strongly indicate that the buccal and nasal secretions lose their infectivity with the beginning of convalescence. Anderson and Goldberger completely failed to transmit the disease by means of the "scales." These experiments have been confirmed by other observers, and the experimental facts taken with the epidemiological evidence warrant the following conclusions:

Method of Transmission.—By immediate contact with patients in the prodromal stage of the disease, and by contact with atypical and missed cases. Aerial transmission is possible for short distances by infected droplets expelled in sneezing and coughing, and this is probably the usual method among soldiers, especially when overcrowded. We may say that:

1. A case of measles may be in the infective stage as early as five days before the appearance of the exanthem, but not before the appearance of prodromal symptoms (coryza).
2. The height of infectivity occurs with the appearance of the exanthem.
3. The infectivity of the disease does not extend beyond

seven days after the appearance of the exanthem. Experience of the New York Board of Health is that the disease is probably not infective five days after the appearance of the rash. On these facts a rational campaign against the disease may be formulated with hope of success.

INCUBATION PERIOD.—Seven to fourteen days, oftenest fourteen. (Osler.) In 254 cases the minimal period from exposure to first symptoms was seven days, the maximal fourteen days, the average eleven days. The minimal period from first symptoms to appearance of exanthem was one day, maximal seven days, average three days.

PROPHYLAXIS.—This disease is most common among young soldiers, is often a rather serious illness, and has caused more trouble to military sanitarians than all the other exanthemata, because in the past it has been practically uncontrollable, and has almost always assumed epidemic proportions. It is believed that in the future this may be avoided.

I. *Specific Measures.*

1. Prompt notification of all cases or suspects.

2. Isolate all known cases in the hospital, the isolation to continue five days after the exanthem.

3. Determine so far as possible all contacts. All tent mates are contacts.

4. Find out what contacts have had measles. If this can be definitely ascertained, such men need not be isolated as the immunity to measles is practically permanent. In case of doubt or when a history of German measles is given, isolate.

5. Place all non-immune contacts in a detention ward. If necessary, they may be permitted to perform their duties for seven days after the contact (the minimum incubation period) but thereafter they must be strictly isolated and observed for ten days. If measles does not develop within eighteen days from last contact, they may be released.

6. Isolate in another ward or tent all soldiers of the organization who develop symptoms of coryza, as soon as the

symptoms appear. Non-commissioned officers should be instructed to watch for and recognize the symptoms of a cold, so that these cases may be isolated at the earliest possible moment.

7. Terminal disinfection after measles is useless and unnecessary, since transmission of measles by third parties or by fomites must be exceedingly rare, if it occurs at all.

II. *General Measures.*—Take all possible steps to avoid overcrowding. Not only measles but all respiratory diseases are much more apt to spread when the men are overcrowded. (See Overcrowding.)

MUMPS.

ETIOLOGY.—The etiological agent is unknown. The disease may be caused by a filtrable virus, as Wolbach has succeeded in producing parotitis in animals with filtered bacteria-free extracts of saliva from cases of mumps.

PREVALENCE.—A disease of childhood and adolescence. In barracks the disease has been known to attack 90 per cent. of the soldiers, and it very commonly occurs among young recruits. While the disease is generally not at all serious in its clinical aspects, yet it causes great impairment of efficiency for prolonged periods, and for this reason as much care as possible should be taken to avoid the infection, and to limit its spread should it occur.

PERIOD OF INCUBATION.—From two to three weeks. (Osler.)

Method of Transmission.—There is little experimental evidence concerning the method of transmission, but numerous clinical observations indicate that the disease is directly contagious, although the degree of contagiousness is probably not great. There can be little doubt that the virus is present in the saliva of those infected and is transmitted by direct contact, by recent indirect contact, and perhaps to some extent the droplets of saliva are conveyed from one patient

to another by coughing. Probably the chief vehicle for the conveyance of saliva from one to another is the fingers. The fingers are put in the mouth for some reason, or for no reason at all, and the virus is distributed to everything the hand touches. The soldier spreads his saliva on his playing cards for example, and others handling these cards transfer it fresh and virulent to their own mouths. Common drinking cups, pencils, pipes, spoons and other objects introduced into the mouth soon after their use by another person all assist in transferring the virus. Cases of mumps may remain infectious for six weeks.

CONTROL.—I. *General Measures.*—(See note on Overcrowding and Contact Infection.)

1. Educate the soldiers to stop the trade in saliva. Post notices in conspicuous places, and explain reason for rules in informal talks.

2. Take measures to prevent overcrowding and to give as much room as possible to each man.

II. *Specific Measures.*—When a case of mumps occurs, if the disease is prevalent among the surrounding population and if the soldiers mix freely with this population, isolation will probably be of little value, as fresh infections will continue to be received from outside the camp. But if the camp is located at some distance from other foci of infection, isolation if prompt, may avert an epidemic. Under these circumstances

1. Isolate the case in the hospital for six weeks.

2. Place all his tent mates and immediate contacts who have not had mumps in a detention ward for three weeks. Second attacks of mumps are very rare so that all those who have had the disease may be regarded as immune and need not be isolated.

3. Should no further cases develop, all may be discharged at the end of three weeks. Should secondary cases occur among the contacts these must in turn be isolated for six

weeks, and the period of detention for the remaining contacts should be three weeks from the last case of mumps.

NOTE.—If this action is taken when the first case occurs, the prospect of checking the disease is excellent, as the contagion is not very active, and all infected cases may be removed at once from the general command. But if action is delayed until a number of cases occur, or if fresh cases continue to be introduced from the outside, little can be expected of isolation, and the period of incubation and infectiousness combined is so long (nine weeks), that isolation is sure to become unduly burdensome, as well as ineffective.

PLAGUE.

ETIOLOGY.—Bacillus pestis.

Method of Transmission.—In pneumonic plague the bacilli are present in the sputum in great numbers and infection is transmitted from one person to another by contact or by means of the droplets expelled in coughing or speaking. Bubonic plague is contracted only through the bites of fleas previously infected from plague rats. Plague is primarily a disease of rats. Xenopsylla cheopis, the rat flea of the tropics, will also bite man readily and is the common transmitter of plague. This flea becomes infected from the rat, and leaves the rat after its death and often attacks man. Plague bacilli develop readily in the alimentary tract of the flea even to the point of forming masses that cause an intestinal or pharyngeal obstruction. The flea always regurgitates while feeding, and a plague-infected flea suffering from this obstruction regurgitates even more than usual, and is therefore almost certain to regurgitate plague bacilli into the wound. Infection is practically certain to follow, as man has very little resistance against these organisms.

PERIOD OF INCUBATION.—The possible variations in this period are not known with accuracy, as it is seldom known when the infection is received. The United States Quaran-

tine Regulations state that seven days shall be considered the incubation period of plague for quarantine purposes. This may be taken as the longest possible incubation period.

PROPHYLAXIS AND CONTROL.—Since plague is primarily a rat disease, all sanitary measures are directed against that animal. Suppression of human cases does not mean eradication of plague; in Havana eighteen months elapsed between presumptive eradication in 1912 and its reappearance in 1914, while in San Francisco rodent plague was found eight months after the last human case. The rodent case incidence is therefore more significant to the sanitarian than the human case incidence. Human cases may be isolated if it is thought desirable, but no great precautions need be taken, as the disease (unless pneumonic) is practically never transmitted from man to man. The following measures should be taken:

I. *Eradication of Disease when Already present.*

1. The town should be divided into districts with a sanitary officer in charge of each district together with the proper sanitary personnel including rat catchers and artisans capable of conducting rat-proofing operations.

2. In each district headquarters a map is placed, upon which cases of human plague may be spotted with pins of one color and rat plague with pins of another color.

3. As soon as a house is spotted with either human or rat plague, draw radiating lines from that point outward. The rat catchers work along these lines and thus determine the point farthest from the infected center where any infected rats are found. Connecting lines drawn between these outside points on the radii determine the area in which rat-catching squads should concentrate their efforts. It is a mistake to begin catching rats at the center, as this merely drives the rats farther out. Squads work inward from the outside and endeavor to kill all rats. Hiding places are torn open and destroyed. In Manila terriers were found very useful to catch the rats as they ran from their hiding places. Houses may be fumigated and traps and poisons may be used.

4. In addition to this work in infected foci a general rat-catching campaign is conducted in each district by means of systematic trapping, poisoning and other measures.

5. All rats caught or killed are tagged with the location where caught and are immersed in a disinfectant solution to kill the fleas, after which they are sent to the central laboratory where all rats caught must be examined daily to determine whether they are infected with plague. This work may be done very rapidly, and one skilled laboratory man with several assistants to open the rats can pass on several hundred rats daily. When a plague rat is found, the tag is consulted, and the exact locality where it was found is sent to district headquarters. This is spotted on the map and constitutes a new focus to be dealt with as outlined above.

6. As fast as a particular locality is cleared of rats, it should be rendered rat-proof as far as possible.

II. *Restrictive Measures to Prevent the Entrance of Plague.*

1. *Ships.*—All ships from plague-infected ports should if possible be fumigated before being docked. Either sulphur dioxide, carbon monoxide or hydrocyanic acid may be used, and in this way both ship and cargo will be freed of rats. If this cannot be done, the ship should be kept six feet from the dock, the hawsers should be fitted with rat guards, unloading should be done only by daylight and no gangplank left down at night. These measures are all necessary to prevent rats from leaving the ship.

2. *Railroad Terminals.*—All freight cars entering from infected regions should be fumigated in the same way to kill all rats before the cargo is unloaded. Baggage cars may also be fumigated if this is considered necessary. Cargo should be required to be stored in rat-proof warehouses before and after loading which should be done during daylight. Cars should be constructed so that a rat cannot enter the car after it is loaded and the door is closed. Undetected rats in freight are often responsible for the spread of infection, and

this was undoubtedly the cause of the reintroduction of plague in Manila after it had been absent from the city for a period of about ten years.

To successfully cope with plague, assume that the entire city is infected and employ a maximum number of sanitary personnel at the beginning. By means of widespread trapping and examination of the daily catch, the infected areas can be determined at an early date in the campaign.

Trapping.—Is the most dependable method for catching rats. It is effective and the catch is available for examination which is not always the case when poison is used. The spring trap was found most efficient in Manila, though all types may be used.

Destruction of Harborage.—Remove old floors and open up hollow walls and ceilings. This work must be done during daylight and terriers should be used to catch the rats that endeavor to escape.

Removal of Rat Food.—Every endeavor must be made to remove all sources of food. It has been found that rats normally breed up to the limit of the food supply, and that when a great number are killed off, the ones that are left breed much more rapidly so long as plenty of food is available. Garbage must be kept in metallic cans with tight covers. Groceries, bakeries, markets and stables and establishments of like character should be required to have concrete floors with protected walls, ceilings, roofs and doors. When plank floors are used, they must be well elevated with the underpining free, or protected by a marginal wall of masonry.

Rat-proofing.—If the rodent population is reduced to a low level, rat-proof construction automatically maintains this low level. It is impossible to eliminate the rat, but if the rodent population is reduced 50 to 80 per cent., and congested rat centers are eliminated, plague will probably disappear, and the rat-proof construction will prevent any great increase in the rodent population. In protecting a building if possible

elevate it one to three feet above the ground and keep it clear underneath. This eliminates harborage under the building. Or construct an impervious wall of masonary two feet beneath the surface of the earth and meeting the floor flush. Concrete floors are ideal and should be required where food is stored. Double walls can be protected by metal flashing at the junction of the floor and the wall where rats begin to gnaw, or obliteration of the wall space may be secured by a concrete or brick fill extending upward one foot from the floor level. If the tiles of the roof are infested, these may be replaced by simple galvanized iron which does not afford any harborage. Doors of warehouses should be sliding, close-fitting and the door sills should be composed of concrete, and should be raised several inches above the ground. Such doors should always be closed at night, and should be guarded by a watchman in the daytime. Rats are often very bold and will run through these doors in broad daylight. This is less likely to happen if the door sill is at least six inches above the level of the ground.

RABIES (HYDROPHOBIA).

Rabies is unusual among soldiers, but it may occur at any time, and as the disease is always fatal after it has once developed, medical officers should know exactly what steps to take to prevent the development of the disease in case men are bitten.

ETIOLOGY.—A filtrable virus is at present unknown. Negri bodies are found in the brain in all cases of the disease and may be either a phase in the development of the organism, or more probably a product of its growth.

Method of Transmission.—The virus is present in the saliva of animals suffering with the disease, and is inoculated by the bite of the infected animal. The disease is generally transmitted to man by the bite of rabid dogs, though sometimes by the bite of rabid cats, wolves, coyotes, skunks, and other wild animals.

PERIOD OF INCUBATON—The minimum is perhaps twelve days. The average incubation period of 510 cases was seventy-two days. In exceptional cases the incubation period may be very long (eight to ten months), and at least one case is on record that died twenty-two months after infection. The length of the incubation period depends upon the location of the bite (nearness to a nerve and to the head; the virus travels to the brain along the nerves), character of the bite, and presence or absence of clothing.

Incubation Period in the Dog.—When a dog is bitten by a rabid animal in the usual way, the incubation period averages from five to eight weeks. Rabies develops within two months in 83 per cent. of the cases, within three months in 99 per cent., and the remaining 1 per cent. in four months or later.

PROPHYLAXIS.—I. *Procedure to be Followed in Case of Dog Bites.*—1. Keep the dog alive and carefully isolated and watch for the development of rabies. If the dog is rabid, it will die of the disease shortly. If the dog remains well for ten days it was not rabid.

2. If the dog has been killed, send the body if possible, and at least send the head to the nearest department laboratory so that the brain may be examined for Negri bodies, and by inoculation experiments in rabbits. Rabbits are most susceptible to this virus.

3. Indications for Prophylactic Treatment.

(*a*) All cases in which the dog has been proved to be rabid.

(*b*) All cases in which nothing is known of the dog, especially if rabies has already occurred in dogs or man in the vicinity, or when the dog has behaved in a suspicious manner.

(*c*) If the dog is well known and does not develop rabies in ten days, no treatment is necessary.

II. *Methods to be Taken against Dogs.*—Rabies can be stamped out by muzzling all known dogs for a sufficient length of time, and destroying all stray dogs. Two years after the

last case the muzzling may be discontinued. Therefore should a case of rabies occur, all valuable dogs should be muzzled, and all stray dogs should be killed.

Method of Obtaining the Prophylactic Treatment.—(See circular No. 9, W. D., 1912.)

Results of Prophylactic Inoculation.—1. With regard to the protection afforded. Of 152,829 cases treated, 705 or 0.46 per cent. died. Many of these received the treatment too late.

2. With regard to injurious effects. The inoculation is not devoid of danger. Of 110,000 cases so treated, about 40 have developed paralytic phenomena. Moreover, the injections extend over a considerable period, and are painful. Therefore avoid the use of the prophylactic except in cases where it is indicated, but in these cases use it without hesitation, as it affords a high degree of protection and the danger is infinitesimal as compared with the danger of developing rabies. The advisability of not killing the dog that has bitten, but of isolating and watching it, cannot be emphasized too strongly. Unfortunately, most people lose their heads where this disease is concerned, and the first impulse is always to kill the dog. This makes it much more difficult to determine whether the dog was rabid and whether the patient needs the prophylactic treatment. Moreover, if the dog has been killed it should be shipped promptly, and if possible packed in ice so that it may arrive at the laboratory before decompositon has set in. The search for Negri bodies is much less reliable after decomposition has set in. In this case, animal inoculation is all that is left, and this takes some time.

Circular No. 9, W. D., Office of the Surgeon-General, Washington, September 19, 1912. The following information relating to the treatment at army posts of cases of suspected rabies is published for the information of all medical officers:

Through the courtesy of the Public Health Service the virus will be furnished by the Hygienic Laboratory, Washington, D. C. Whenever antirabic treatment for any person at a post is deemed necessary by the surgeon, he will telegraph a request for the same to the director, Hygienic Laboratory, Twenty-fifth and E Streets N.W., Washington, D. C. Post surgeons in the Western Division should also telegraph, at once, a requisition to the medical supply officer, San Francisco, Cal., for the virus for beginning the treatment. This should be done in order that the treatment may be begun as early as possible. The incubative period is shorter in children and in bites of the face and head, and wounds in these parts are the most dangerous.

The animal that is supposed to be rabid should be secured, if possible, and kept under observation until the diagnosis can be positively made. After the death of the animal, or if the animal is killed and it is impracticable to examine the brain for Negri bodies at the post, it should at once be sent either to the laboratory of the Army Medical School, Washington, D. C., Fort Leavenworth, Kan., or the Letterman General Hospital, San Francisco, Cal. If the brain will reach the laboratory within twenty-four hours it should be carefully packed in ice, otherwise the brain, or at least that portion of it containing the hypocampus, should be placed in pure glycerin.

A careful record of the case should be kept describing the injury, the treatment, and subsequent history, with dates. All the details regarding the rabid animal and the data upon which the diagnosis was made should be included. Upon completion of the treatment a copy of this record should be forwarded to the Surgeon-General of the Army for transmission to the director of the Hygienic Laboratory.

DIRECTIONS FOR THE USE OF RABIES VIRUS SHIPPED FROM THE HYGIENIC LABORATORY, PUBLIC HEALTH SERVICE, WASHINGTON, D. C.—The virus should be kept in an ice-box

or other cold place. This material is perishable and must not be kept on hand for future use. Each bottle contains the number of doses required, until further shipments are made, of cord dried for the number of days indicated on the label. Further shipments of cord to complete treatment already begun are made without further request.

Dose.—Each small section of cord (about 1 to 8 cm.) constitutes one dose.

The following equipment is necessary for making and using the emulsion: Physiological salt solution; alcohol; absorbent cotton or gauze; glass or porcelain mortar and pestle (capacity 10 to 20 c.c.); thumb forceps; hypodermic syringe (at least 3 c.c. capacity), with large needle; glass pipette, 5 c.c., graduated at least to 0.5 c.c.; small conical test-glass or beaker or other small container. These must be sterilized and then the instruments, etc., rinsed in sterile salt solution. The technic must be aseptic throughout.

To Make the Emulsion.—Remove one section of cord from the bottle with the thumb forceps and rinse it free of glycerin with sterile salt solution in the small glass container, place it in the empty mortar, and, without the addition of any fluid, rub up as finely as possible. Then 2.5 c.c. of the salt solution are gradually added by means of the pipette, taking care between the additions of the salt solution to rub to a uniform consistency. Draw all of the emulsion into the syringe.

To Use.—Scrub the skin at the site of inoculation with alcohol and inject the emulsion into the subcutaneous tissue, being careful not to injure muscular layers or visible veins. Alternate successive injections on the two sides of the anterior abdominal wall.

For the schemes of injection see following table:

SCHEME FOR INTENSIVE TREATMENT.

Twenty-five doses.

Day of treatment.	Cord marked.	Number of injections.	Amount injected.		
			Adult.	5 to 10 years.	1 to 5 years.
			c.c.	c.c.	c.c.
1	8–7–6	3 injections, interval 3 hours	2.5	2.5	2.5
2	4–3	2 injections, interval 6 hours	2.5	2.5	2.0
3	5–4	2 injections, interval 6 hours	2.5	2.5	2.5
4	3	1 injection	2.5	2.5	2.0
5	3	1 injection	2.5	2.5	2.0
6	2	1 injection	2.5	2.0	1.5
7	2	1 injection	2.5	2.5	2.0
8	1	1 injection	2.5	1.5	1.0
9	5	1 injection	2.5	2.5	2.5
10	4	1 injection	2.5	2.5	2.5
11	4	1 injection	2.5	2.5	2.5
12	3	1 injection	2.5	2.5	2.0
13	3	1 injection	2.5	2.5	2.0
14	2	1 injection	2.5	2.5	2.0
15	2	1 injection	2.5	2.5	2.0
16	4	1 injection	2.5	2.5	2.5
17	3	1 injection	2.5	2.5	2.5
18	2	1 injection	2.5	2.5	2.0
19	3	1 injection	2.5	2.5	2.0
20	2	1 injection	2.5	2.5	2.5
21	1	1 injection	2.5	2.5	2.0

GEO. H. TORNEY,
Surgeon-General, United States Army.

Approved:

BY ORDER OF THE SECRETARY OF WAR:

LEONARD WOOD,
Major-General, Chief of Staff.

SCARLET FEVER.

Scarlet fever is not widely prevalent in the army, but cases occur from time to time. It is not so highly infectious as measles and does not tend to become epidemic among soldiers who apparently have passed the period of greatest susceptibility.

ETIOLOGY.—The cause of scarlet fever is unknown.

Method of Transmission.—The evidence indicates that the chief if not the only source of infection is the secretions of the mucous membranes of the nose, throat and respiratory tract, and the infection probably enters the body by the same routes. According to the best opinion today, the desquamation plays no part in transmitting infection. Fomites which were formerly considered of great importance in this disease are probably a negligible factor. Carriers and mild missed cases undoubtedly play a major role in disseminating scarlet fever, but it is sometimes transmitted by milk, the literature containing 51 epidemics believed to have been caused by milk supposedly infected during the handling prior to its sale.

PERIOD OF INCUBATION.—One to seven days, oftenest two to four. (Osler.)

CONTROL.

I. *General Measures.*

1. Prevention of overcrowding and contact infection.
2. Pasteurization of all milk supplies.

II. *Specific Measures.*

1. Prompt notification.
2. Isolation of cases in hospital with disinfection of the discharges from the mouth and nose. As no one knows how long a case remains infective, the period of isolation is largely guesswork and varies in different cities from three to eight weeks. Rosenau states that fifty days may be taken as a safe average. The Committee on Communicable Diseases of the American Public Health Association reported in 1913 that "cases may be released when abnormal discharges have ceased

and the patient appears normal (even if desquamation is incomplete). A minimum of four weeks should, however, be maintained."

3. Isolation of contacts in small groups during the incubation period (seven days). If scarlet fever does not develop in this time they may be released.

4. Terminal disinfection with formaldehyde may be practised if desired, but is probably useless.

SMALLPOX.

Smallpox is almost never seen in the army, as the entire personnel is vaccinated, but it may be encountered among the native population in many places where the army may be sent.

ETIOLOGY.—The etiological agent is still unknown.

Method of Transmission.—Is also unknown, although it is known that the disease is very contagious.

INCUBATION PERIOD.—Nine to fifteen days, oftenest twelve days. (Osler.)

PROPHYLAXIS.—Vaccination is a sovereign prophylactic. When performed in a systematic way (revaccination), smallpox is unknown.

Duration of the Immunity Afforded by Vaccination.—99.9 of those never vaccinated will take if the vaccine is potent. Of those vaccinated after one year 14 to 28 per cent. take when revaccinated. After five years, 50 to 51 per cent. take when revaccinated; after ten years, 85 to 89 per cent. take when revaccinated.

Rules for Revaccination.—1. The general population should be vaccinated about every five years if smallpox is present in the community. In the army all recruits must be vaccinated when enlisted, and all soldiers upon reënlistment. (See par. 92, M. M. D., 1916.) Medical officers should be on guard to see that these regulations are complied with. When in contact with a population having smallpox, occasional cases do occur in the army, in every case due to the fact that this regulation has not been strictly complied with.

2. Anyone directly exposed to smallpox should be vaccinated at once if a successful vaccination has not been made within nine months. This vaccination should be made at once, as the protection conferred depends upon the interval between infection and the vaccination. If vaccination is performed within four days after exposure, a successful vaccination may protect against the disease. After a longer interval smallpox develops, but in a somewhat modified form.

3. When the army enters a territory where smallpox is prevalent among the natives, a general vaccination of the population should be made for their own sake and to protect the command.

To Obtain Vaccine Virus.—Smallpox vaccine will be asked for by letter addressed to the Department Surgeon. On account of the liability of this product to become inert, only such quantities as are needed for early use will be asked for.

Isolation.—Smallpox is infectious from the earliest manifestations of the disease until all crusts are removed. Isolation should cover this entire period. Those who have been exposed should be placed in a detention camp and watched for sixteen days. *The Quarantine Laws and Regulations of the United States*, 1910, p. 40, give fourteen days as the incubation period of smallpox for quarantine purposes.

TETANUS.

ETIOLOGY.—Bacillus tetani.

Method of Transmission.—The organism is a spore-bearer and can live for long periods in the ground. It is commonly found in the intestinal tract of horses and other animals, so that the soil of cultivated lands where manure has been used is frequently highly infectious. At the beginning of the war tetanus was quite common among wounded soldiers, owing to the fact that clothes and wounds were all contaminated with this infected mud from the trenches. Gas bacillus infection (B. aërogenes capsulatus Welch) is acquired in precisely the same way.

INCUBATION PERIOD.—One to twenty days. The average incubation period of 43 fatal cases was 8.8 days and that of 26 cases that recovered was 11.5 days.

PROPHYLAXIS.—1. *Specific.*—All suspicious wounds, *i. e.*, all lacerated, contused, and punctured wounds inflicted under such circumstances that soil or dirt may have been introduced require prophylactic treatment. In the English service it has been directed that a dose of antitoxin be given to every wounded man. This should be given subcutaneously at a distance from the wound at the earliest possible moment. (First-aid Station or Dressing Station); 500 to 1000 units may be given. The English have found a dose of 500 units satisfactory, and since adopting this practice during six months the English army had only 36 cases of tetanus among those wounded who received the antitoxin within twenty-four hours after injury. More recently a second dose of 500 units is given when the patient arrives at the base hospital, if the wound is of any severity.

2. *General.*—Wounds should be freely opened, thoroughly cleaned and properly drained at the earliest possible moment. This also aids in preventing gas bacillus infection. Both of these organisms are strict anaërobes and can therefore only develop in the depths of wounds.

TUBERCULOSIS.

There has been a great increase in the number of soldiers suffering from tuberculosis as the result of war conditions in Europe. Many factors have contributed to this increase, including overcrowding, undernourishment (particularly in prison camps), exposure, and insufficient facilities for the diagnosis, segregation, and treatment of already existing cases. Many of these conditions are unavoidable, owing to military necessity, but sanitary officers should exert all possible efforts to minimize these conditions, as the extension of the disease will prove a serious menace to the efficiency of the command.

ETIOLOGY.—Bacillus tuberculosis.

Method of Transmission.—The evidence at hand indicates that the respiratory tract is the route of infection in the majority of cases, the organism being transmitted by dried and pulverized sputum or by droplet infection. It may be transmitted by milk, and perhaps about 7 per cent. of tuberculosis in man is of bovine origin; but the great majority of these bovine infections consist of generalized abdominal and glandular tuberculosis in children, scarcely any being pulmonary. It must not be forgotten that many, perhaps the majority, of adults are already infected and suffer from a small walled-off lesion or a latent focus which under ordinary circumstances of life would never cause any trouble, but which develop into an acute pulmonary infection when the resistance is diminished by the strains, exposure and increased exertions incident to war.

PROPHYLAXIS.—I. *Restriction of the Spread of the Tubercle Bacillus.*—1. *Diagnosis of Existing Cases.*—Provision should be made for the examination of sputum. In concentration camps the sputum may be examined in the camp hospital or may be sent to the nearest department laboratory. In active service provision should be made for the examination of sputum at the field hospitals. A microscope, glass slides, sputum bottles and a few simple stains (carbol-fuchsin and methylene blue) are all that are required for this purpose. The sputum of all men who have had a cough four weeks or more should be examined.

2. When tubercle bacilli have been detected in the sputum, the man should be removed to a base hospital or sanatorium. If this is not done, the man will certainly serve as an active focus of infection to his comrades under the conditions of camp or trench life. Here all sputum will be disinfected, and the man educated to avoid infecting others.

3. The prevention of promiscuous spitting. Spitting should be prohibited by order, and the order enforced as far as

possible. In addition the men should be educated to understand that spitting spreads tuberculosis and other diseases.

II. *Promotion of the Vital Resistance of Individual Soldiers.*—So far as war conditions permit, sanitary officers must take steps to prevent overcrowding, defective ventilation, underfeeding, exposure, loss of sleep and other generally unhealthful conditions. Sunlight is a good disinfectant, and camp orders provide for the sunning of tents, bedding and equipment.

TYPHUS FEVER.

ETIOLOGY.—The organism causing this disease is possibly an anaërobic bacillus isolated by Plotz, although this is not accepted by all authorities.

Method of Transmission.—It has been definitely proved that typhus is transmitted by the bite of infected lice. P. vestimenti is the usual transmitter, but typhus may be transmitted by P. capitis. All evidence indicates that the disease cannot be acquired in any other method than by the bite of lice that have become infected from a previous case. The virus exists in the circulating blood during the period of the fever, and probably for thirty-six hours after. Lice feed daily or oftener, therefore if a louse that has bitten a typhus case gains access to another man, it is practically certain to bite him and infect him within a few hours. It might be supposed that this infection would be easy to avoid, but experience has shown that the reverse is the case. There is no disease that has numbered more victims among attending physicians and nurses than typhus, and where soldiers are closely congregated the difficulty in preventing infestation is enormous. Peacock examined the men of one division in the trenches in France and found 95 per cent. of the men infested with an average of twenty lice per man. Five per cent. were maximum cases, the number of lice ranging from 200 to 10,000 per man. The main source of infection is the soldier himself, particularly this small percentage that are grossly infested and serve as

carriers. Infinite precautions must therefore be taken to prevent this infestation.

INCUBATION PERIOD.—Five to fifteen days, usually nine to twelve days.

PROPHYLAXIS.—All measures of prevention are centered upon the louse as follows:

I. Measures for the prevention of lice infestation among the soldiers in general.

(*a*) Keep hair short.

(*b*) Change and launder all underclothing at least once a week when possible. Iron clothes, including trousers and shirts, particularly over the seams, to kill eggs.

(*c*) Each man should search his clothing daily for lice or nits; pay special attention to seams particularly at the fork of the trousers.

(*d*) When soldiers are compelled to sleep close together and clothes cannot be changed, as in the trenches, infestation may be prevented by the use of naphthalin. Naphthalin kills adult lice *but does not kill the eggs*. The naphthalin must therefore be applied at intervals of four days on the principle of fractional sterilization. Before going to sleep, introduce a handful of finely powdered naphthalin into the clothes through the opening at the neck. The naphthalin evaporates and kills adult lice. The advantages claimed for this method are that it is cheap, requires neither special apparatus nor place, does not injure either the man or his clothing, and does not interfere with the service efficiency of the man. The British have found the following N. C. I. powder to be most effective: It is composed of naphthalin 96 parts, creosote 2 parts, iodoform 2 parts. This powder is dusted into the clothes, but care must be used to avoid the crotch, where this powder causes much smarting. Crude oil ointment may be used about the crotch. Two pounds of soft paraffin are melted and 4 ounces of crude tar oil are added. This is also most effective, and the use of the ointment and powder combined will keep the men free of lice.

(*e*) In trenches and similar places a man should be appointed to distribute this powder, and company officers should see that their men use proper precautions as outlined above.

(*f*) A general inspection for lice once a week is recommended.

(*g*) Stations for delousing. Bathing facilities must be provided at some place for the men. Arrangements should be made so that while the bath is being taken, the clothes may be passed through a steam sterilizer. When the bath is finished the men pass into a dressing room where clean clothes are issued. The hair should be cut and treated if necessary before the bath. The Germans are said to have employed these measures on a large scale by converting factories into stations for delousing, and it is claimed that some of these stations were able to bathe and sterilize the clothes of from 12,000 to 15,000 men in one day.

II. Destruction of all lice and eggs found on bodies, clothing, bedding, and surroundings of all cases of typhus, typhus suspects, and contacts.

(*a*) Prompt notification to sanitary authorities of all cases or suspected cases of typhus. All cases of fever are suspects in the presence of an epidemic. Such cases with all bedding and clothing should be removed to the hospital.

(*b*) All contacts with these cases should be removed to a detention ward or camp, with their bedding and clothing. Contacts should be kept under observation at least twelve days.

(*c*) *Destruction of All Lice and Eggs.*—Hospitals and detention camps must be equipped to perform this work efficiently. For treatment of bedding and clothing, steam is the method of choice. When steam is not available, clothes may be boiled or dipped in gasoline. No single method is absolutely satisfactory. Sulphur fumigation kills adult lice but *does not kill the eggs*, and in addition injures some fabrics. Steam ruins leather leggings, shoes and hats. Hot air is

difficult to control; too great heat injures fabrics and too little fails to kill lice. Hence methods must be combined if delousing is to be efficient without damaging equipment. The following method, based on that in use at the Quarantine Station at New York, is suggested because it has proved efficacious. Out of 4000 baths, not a single case of typhus has developed outside the incubation period:

On arrival of contacts or cases each man is given an open-mesh cotton bag, 24 to 30 inches, into which all cotton and woolen goods of all kinds, including those from lockers or trunks, are put. Lockers, trunks, shoes, and leggings may be transferred to a closed room and fumigated overnight, burning 8 pounds of sulphur to 1000 cubic feet. The mesh bag containing all clothes is tagged with a number on a metal tag, the duplicate being given to the man to hang about his neck. The bag is placed in the sterilizer, and the men then pass stripped into a shower-bath room, where the attendant examines the hair to see if lice are present. If lice are found, the hair is clipped short with No. 00 clippers, the hair dropping on a paper, which is then rolled up and burned. After being passed through this process, liquid soap is sprayed upon the body from an elevated reservoir, and the man proceeds to the baths. The soap container may be a 5-gallon can with a tube from the bottom with clip and spray attachment. The soap may be made by boiling 1 part soap chips in 4 parts of water and then adding 2 parts of kerosene oil. This jellies when cold, and 1 part of this soap jelly is added to 4 parts of warm water, making a good liquid soap for this purpose. Meanwhile the clothes are disinfected by steam under pressure, dried *in vacuo*, and when the bath is finished the men pass from the bath room into the clean room and receive their clothes. Before clothes are put in the bag for sterilization, all money and other valuables must be removed. They may be dipped in 50 per cent. alcohol, if considered necessary, and should be kept in a sealed envelope with the owner's name plainly written on it. A thorough inspection of each deten-

tion is made daily for lice and the temperature is taken both night and morning. All typhus suspects and cases must be thoroughly deloused before admission to hospital or detention wards. If no lice are admitted the disease cannot spread, and further isolation is therefore unnecessary. However, if such patients are admitted to a general ward, all patients admitted must be deloused, in order that there may be no possibility of the typhus patient contracting a fresh infestation from some other patient.

III. Adoption of measures by persons in contact with typhus (doctors and nurses) to prevent the possibility of their being bitten by lice.

1. Doctors, nurses, and those engaged in the process of delousing should employ the following precautions: The hair should be worn very short, and clothes should be worn in such a manner that a louse cannot bite or gain access to the interior of the clothing. For this purpose boots preferably of rubber should be worn, with an operating gown or white coat tightly fastened at the wrists, and if possible, with rubber gloves on the hands and fitting over the sleeves. A muslin cap should be worn which will cover all the hair, leaving only the face exposed.

2. Care should be exercised to avoid allowing the clothing to touch patients, furniture, bedding, or clothing that is known or suspected to be infected.

3. After going off duty the gown, cap, and gloves may be boiled, and the boots should be washed off with kerosene or bichloride, and a careful inspection of the person and clothing for vermin must be made. A bath and complete change would be advisable when possible.

TYPHOID FEVER.

ETIOLOGY.—Bacillus typhosus. The same clinical condition may also be produced by the B. paratyphosus A. or the B. parathyphosus B.

Method of Transmission.—The bacilli from the excreta of a previous case must be swallowed. Typhoid may be transmitted through water, milk, infected food, or by direct contact with a case of the disease or with a carrier. As water and milk supplies are generally closely supervised, the usual method of transmission among soldiers is by contact and by infected food or drink. These may become infected directly by carriers or indirectly by flies. Reed Vaughn and Shakespeare showed that most of the typhoid contracted during the Spanish War was contact infection. Probably every regiment brought into camp one or more mild unrecognized cases or carriers, and these were the starting-point of outbreaks. Of 1608 cases studied, 35 per cent. were directly connectible, and 27.8 per cent. more were indirectly connectible; so that 62.8 per cent. of the cases were spread by contact. Owing to the unsatisfactory methods of excreta disposal, the shoes, clothing and hands of the men, and even blankets and tentage, became soiled with the excreta, and by such contacts infection became unavoidable. The majority of the remaining cases were probably transmitted by flies directly from the latrines to the food.

Period of Incubation.—Eight to fourteen days, sometimes as long as twenty-three days. (Osler.)

Control.

I. The provision of pure food and drink.

1. The water supply must be above suspicion, or must be purified. (See notes on Purification of Water.)

2. If milk be used, it should be under strict sanitary supervision and preferably pasteurized.

3. All sale of food and drink by unlicensed venders must be prohibited. If the sale of such articles as ice-cream and soft drinks is permitted, these must be under the direct supervision of the sanitary officer.

II. A satisfactory and sanitary disposition of all excreta must be attained. (See Methods for the Disposal of Excreta.)

The strictest precautions must be taken to keep the rears and urinals in a sanitary condition.

III. In order to prevent contact infection from soiled hands, provision must be made for washing the hands after leaving the latrine, and also before meals, and this rule must be enforced.

IV. Prevention of fly transmission.

1. Methods to prevent fly breeding and to kill adult flies. (See Flies.)

2. Screening of kitchens and mess halls to prevent all access to food.

3. All latrines to be kept fly-tight, by screening if necessary, to prevent all access of flies to feces.

4. Rigid enforcement of the rule prohibiting all soiling of the ground with excreta or kitchen wastes.

V. *Management of Carriers.*—When large bodies of men are assembled, it is inevitable that they will include a certain percentage of carriers. It has been estimated that from 1 to 500 to 1 to 250 of the population are typhoid carriers. Therefore should a case of typhoid appear in a company:

1. Examine stools and urine of entire company if practicable. If not, the stools and urine of all cooks, mess attendants, and those concerned in the handling or serving of food must be examined. Specimens of stools and urine should be sent to the nearest department laboratory in accordance with the directions contained in the following circular.

2. If a carrier is detected, he should be isolated in the hospital at once until discharged.

3. No case of typhoid is to be discharged from the hospital until three successive negative stool and urine examinations have been secured, in accordance with the directions in the same circular.

4. All carriers detected should be discharged from the military service, since at present there is no satisfactory method of treating these men, and they are a permanent source of danger.

VI. Management of typhoid cases in hospital.

1. Surgeons should instruct nurses and orderlies with regard to the precautions to be taken to avoid infection.

2. Prompt disinfection of all excreta immediately after passage. Disinfect bed-pans, and keep same closed to prevent access of flies.

3. Hospitals should be fly screened if possible.

VII. *Vaccination.*—(See Circular No. 16, W. D., Office of S. G., March 20, 1916.)—All men are already vaccinated against typhoid in accordance with regulations. The protection thereby afforded is very great, but it is not absolute, hence other precautions should not be relaxed. Moreover, the typhoid vaccine does not protect against the paratyphoid infections, dysentery, and other infections that are transmitted in the same manner as typhoid.

Circular No. 11, W. D., office of the Surgeon-General, Washington, February 24, 1913.

DIAGNOSIS OF TYPHOID AND PARATYPHOID FEVER.—There were among the 61,405 officers and enlisted men stationed in the United States (Continental) 18 cases of typhoid fever during the calendar year 1912; twelve of these, with 3 deaths, occurred among the small number of individuals who, for one reason or another, were not immunized, 5 being recruits who were infected prior to enlistment. There were 6 cases occurring in immunized persons, with no death. It is quite probable that some of these cases may have been paratyphoid fever, as the latter can only be excluded with certainty by cultural methods.

The practical extinction of typhoid fever in the army affords an excellent opportunity to study the prevalence and distribution of paratyphoid fever in the United States, as well as to clear up the etiology of the fevers of undetermined causation. The Widal reaction being of no value in immunized persons, some other method of diagnosis is necessary to distinguish between typhoid and paratyphoid and other

continued fevers. This is best accomplished by blood cultures, and it is desired that medical officers make use of them to a greater extent than is now the case.

Each post in the United States should have on hand at all times a few standard bottles of bile media for use in making such cultures. Full directions for use will be furnished with each bottle. Requisitions should be made immediately by information slip for an adequate supply, not less than two bottles, basing the requisition on the number of typhoid suspects, etc., during the last three months. As the bottles are used, additional requisitions should be submitted. The blood is obtained from a vein at the bend of the elbow with a large sterile syringe. The bottle is opened, taking care not to contaminate it, and from 2 to 5 c.c. of blood is added to the bile. The bottle is sealed with paraffin or sealing wax, wrapped in absorbent cotton, and sent in an approved mailing case to the nearest department laboratory, with a brief history of the case.

Brion and Kayser report 100 per cent. of successful blood cultures during the first week of typhoid; others report 84 per cent. positive during first week, 60 per cent. during the second, 56 per cent. in the third, and 48 per cent. in the fourth week. The period of election for blood cultures is between the second and fifth days of the disease, and for Widal reactions, the second week.

At the present time blood culture is the only satisfactory manner of establishing the diagnosis of paratyphoid fever, which cannot be differentiated clinically from mild typhoid. The differential diagnosis by agglutination reactions is difficult and often fails.

The bacilli cannot be isolated from the feces unless they are present constantly and in fair numbers, which is rarely the case early in the disease; therefore this method is not reliable for early diagnosis, although invaluable for the detection of bacillus carriers. This leaves blood culture as the method of choice in the diagnosis of continued fevers.

It is now desired to include the paratyphoid fevers in the statistical tables of the annual reports, and accurate diagnosis, which can only be made in the manner above described, is essential for this purpose.

In case of death, small pieces of spleen should be placed in bile and forwarded, and if ulcers or swollen Peyer's patches are found in the intestines, such parts should be forwarded in 10 per cent. formalin.

GEO. H. TORNEY,
Surgeon-General, U. S. Army.

Approved:
By order of the Secretary of War:
LEONARD WOOD,
Major-General, Chief of Staff.

W. D., OFFICE OF THE SURGEON-GENERAL, WASHINGTON.

DIRECTIONS FOR COLLECTING MATERIAL FROM TYPHOID CASES.

I. DIAGNOSIS.—1. *By Blood Culture.*—The arm is washed with hot soap and water, bichloride, ether, and alcohol. A hypodermic syringe is boiled in 1 per cent. sodium carbonate solution, with the piston drawn out to its full length and the barrel filled with water; at the same time a needle of medium caliber and a pair of thumb forceps are boiled. When all is ready a tourniquet is placed around the arm, and after putting the needle on the syringe with the thumb forceps it is plunged into one of the distended veins at the bend of the elbow and then withdrawn and a small compress is bandaged over the wound. Five to 10 c.c. of blood is put into the ox-bile medium.

If for any reason the use of a syringe is impracticable, blood may be obtained from the ear by a deep puncture made with aseptic precautions. There is no objection to squeezing the ear in order to obtain as much blood as possible.

After inoculation and before mailing the bottle should be sealed with wax or paraffin.

2. *For the Widal Reaction.*—Blood may be forwarded in a capillary tube of large caliber or in a small bottle or vial; 0.5 c.c. (8 drops) should be sent. A short sterile vial is furnished. If the blood is taken from the lobe of the ear it should be cleaned and rubbed until red and then pricked on its border with a bistoury or special blood lancet; there is usually no difficulty in obtaining 30 to 40 drops by squeezing the ear. Blood may be collected from the finger by winding it with a handkerchief or piece of rubber tubing from the root to the distal joint. The finger should be sharply flexed and pricked in one or more places about one-fourth inch above the root of the nail; in this way 10 drops can usually be obtained and as many more by releasing and reapplying the tourniquet. If the bent capillary tube (Wright's capsule) be used, the blood should run in by gravity through the curved end; the straight end is then sealed in the flame, and after the expanded air has cooled, creating a vacuum which sucks the last particle of blood out of the curved end, the latter is also sealed. The bacilli are frequently present in the blood clot in the earliest days of the disease, and may be cultivated from it even when the Widal is still negative.

3. If dried blood be furnished a Widal can be made, but no cultivation of the bacilli from the clot is possible. For this and other reasons fluid blood is preferred.

II. To Determine when it is Safe to Return a Patient to Duty.—The first sample should be sent when convalescence begins.

1. *Feces.*—A small sterile bottle provided with a scoop is furnished for the collection of feces. It is not necessary to fill the bottle, since it is possible to examine not more than a gram or two. If bottles are extemporized they should be washed out with boiling water and no antiseptic used. No germicide should be added to any vessel used by the patient when material is being collected. *No hexamethylenamin or similar drug should be given to the patient for twenty-four hours before the collection of samples.*

2. Urine should be sent in the long vial, *i. e.*, of the same size as the one furnished for feces.

Not less than three sets of samples should be examined at intervals of three days.

III. To Determine the Source of Infection.—Samples of urine and feces may be sent for examination from people with whom the patient has been associated, and from whom he may have contracted the disease.

All material for examination should reach the laboratory in as fresh a condition as possible.

The postal regulations permit the sending of moist specimens of pathological material when the bottles are enclosed in two water-tight tin cans. Care must be taken to see that the washers are inserted in each can and that the tops are screwed on properly.

1. Packages of two sorts will be furnished: (1) for the collection of feces, urine, and blood, and (2) bile media for blood cultures. The second package will not be furnished unless it is specifically requested.

2. The container for bile media is a small bottle of brown glass with glass stopper. The bottle must be surrounded with sufficient absorbent cotton to take up all the fluid in case the bottle breaks.

The threads of the screw-top mailing cases are occasionally jammed in the mail, and when this happens the can may be opened by holding the cap with an encircling piece of heavy wire.

Requests for containers should be addressed to the nearest Department Laboratory.

THE VENEREAL DISEASES; SYPHILIS.

Etiology.—Treponema pallidum.

Method of Transmission.—From 90 to 95 per cent. of infections are the direct result of sexual intercourse with infected persons. The remaining cases of extragenital

infection are indicated by extragenital chancres, of which chancres of the lips and mouth are the most frequent. These extragenital infections are caused by direct or indirect contact with infected persons, usually by means of kissing or the introduction into the mouth of objects recently used by syphilitics, such as cups, pipes, etc. The Treponema pallidum cannot live long outside the body, and when deposited upon external objects with saliva or other secretions from infected persons the organisms die as soon as the secretions dry. Therefore such accidental infections must be due to contact with infectious material that has only left the body very recently.

PERIOD OF INCUBATION.—Clinical observations have placed the incubation period at fifteen days for the minimum and forty-two days for the maximum, with an average of about twenty-five days. Animal inoculations indicate an average incubation period of thirty-eight days with a maximum of sixty days. The longer incubation period in rabbits is probably due to the fact that they are not as susceptible to the disease as is man.

PREVALENCE AND IMPORTANCE IN THE MILITARY SERVICE.—The prevalence of syphilis varies among men of different classes, ages, and races. It is much more prevalent among negroes than among whites, and more prevalent among older than among younger men, etc. From Wassermann surveys it may be estimated that from 5 to 20 per cent. of males are infected, the exact percentage depending upon the circumstances outlined above. As the course of the disease is long with a great tendency to relapses it causes much disability in the army, and as it is often unrecognized, many cases on the sick report masquerading under other diagnoses are in reality syphilis. It is therefore most important that an earnest endeavor be made to reduce this infection to a minimum.

PROPHYLAXIS AND CONTROL.—The disease can be controlled in the military services if commanding officers and

surgeons will coöperate efficiently in carrying out the following measures: A high venereal rate is evidence that sufficient attention is not being paid to this important subject. The measures to be taken may be classified as follows:

I. *Early Diagnosis and Treatment of Existing Cases.*—If treatment is efficient, the existing cases will not transmit their infection to other soldiers (extragenital infections) or to women who in turn may infect other soldiers.

1. In time of peace a Wassermann test on all recruits, all double-plus cases to be followed and treated if necessary by the surgeon to prevent infection and to keep them well and performing duty.

2. Early diagnosis of cases that develop in the command.

(*a*) Education of soldiers to report all cases of venereal disease as soon as noticed.

(*b*) Venereal inspections to detect concealed cases. (See G. O. No. 17, W. D., 1912, included in notes on Venereal Prophylaxis.)

(*c*) Use of modern diagnostic methods. This includes the use of the dark field and special stains to diagnose syphilis in the primary stage when a cure may usually be obtained with proper treatment, and the use and correct interpretation of the Wassermann reaction. Wassermann reactions may be obtained by sending the blood to the nearest department laboratory.

(*d*) Efficient treatment. (See Circular No. 14, W. D., 1914.)

(*e*) Isolation in hospital during the time when he could transmit the infection to others.

(*f*) Each case to be followed with a syphilitic register (Form 78, Med. Dept.), so that the case will not escape from observation and treatment until cured or separated from the service.

II. *The Prevention of New Infections.*

1. So far as possible the men should be educated to abstain from intercourse.

2. *Venereal Prophylaxis.*—(Confidential Circular to Medical Officers. See Venereal Prophylaxis.)—If properly administered promptly after exposure, this will prevent most infections. Surgeons should personally supervise this method to ensure that it is administered efficiently, and to see that men who expose themselves are actually taking the treatment or are punished for their breach of discipline.

3. *Venereal Inspections.*—(G. O. 17, W. D., 1912.)

4. Punishment of those who develop venereal disease without taking the prophylactic. (Par. 2, G. O. 17, W. D., 1912, punishment by court-martial, and G. O. 31, W. D., 1912, and par. 1, G. O. 13, W. D., 1913, with regard to stoppage of pay.)

III. *General Measures to Avoid Contact Infection.*—(See Overcrowding and Contact Infection.)

IV. *Education.*—To be conducted by company commanders and medical officers by means of lectures and informal talks, circulars, etc., containing information as to the nature of venereal diseases, the danger of contracting them and methods of avoiding them, emphasizing the necessity of continence and taking particular care that every man knows the orders with regard to venereal prophylaxis.

Circular No. 14, W. D., office of the Surgeon-General, Washington, August 3, 1914. The following instructions concerning the use of salvarsan and neosalvarsan are published for the information and guidance of medical officers, superseding all previous circulars on this subject:

Indications.—Salvarsan or neosalvarsan is indicated (1) for the rapid control of the manifestations of syphilis, both clinical and serological. For this purpose one or more intravenous injections of the drug are to be given, the dose, interval, and number of injections to be determined by the indications presented in each individual case. It should be recognized that the object of this treatment is to secure prompt amelioration of the symptoms only, and that further treatment will be necessary in order to attain more permanent results. (2) For

the radical cure of syphilis in the primary stage, in combination with an intensive course of treatment with mercury. The possibility of attaining such a cure is now well established. The highest percentage of successful results is obtained in cases treated in the primary stage before the appearance of the Wassermann reaction; in such cases the diagnosis must necessarily rest upon discovery of the parasite in the initial lesion. The combined treatment consists of from three to six intravenous injections of salvarsan, at intervals of from one to two weeks, combined with an intensive course of mercurial treatment by inunction or intramuscular injection, or by both methods, continued for a period of from one to two months. Salvarsan rather than neosalvarsan should be used, and ascending doses should be given, beginning with one-half of the maximum dose. The administration of mercury must be pushed until the physiological limit is reached. Only patients in good health in other respects, and whose kidneys are known to be normal, are suitable for the intensive treatment. The preparation of mercury most used in this country for intramuscular injection is the basic salicylate. A 10 per cent. suspension is made in liquid petrolatum; 0.6 to 1 c.c. of the suspension is to be given at least once a week.

Contra-indications.—Aside from the ordinary contra-indications, such as severe organic disease due to other causes, two possible complications must be kept in mind—*nervous relapse* and *uremia*. Both these conditions may occur, under certain circumstances, after treatment, during the active secondary stage, and cases in this stage must be treated with special caution. Nervous relapse may occur after inadequate treatment in cases where the nervous system is already infected. In such cases one or two injections of salvarsan, not followed up by other treatment, may do more harm than good, and a thorough combined course of treatment should be instituted, or mercury alone used.

Recent literature records a number of deaths following the

administration of salvarsan and neosalvarsan. A certain proportion of these deaths presented identical symptoms; these occurred in the active secondary stage of the disease, two or three days after the second injection of the remedies. The symptoms presented by these cases resembled those of uremia. In our service, during the past three and one-half years, 4 such cases have occurred, 1 after the administration of salvarsan and 3 after the administration of neosalvarsan. During the period referred to over 31,000 doses of the drugs have been issued. Autopsies and histological examinations in 3 of the fatal cases showed an intense acute nephritis. The condition of the kidneys prior to the administration of the drug was not known. While the exact explanation of the cause of these deaths is in doubt, the lesion of the kidneys deserves consideration.

It is directed that, in all cases in which it is contemplated to administer salvarsan or neosalvarsan, the urine of the patient be examined, and should any case show evidence of kidney involvement, that these drugs be withheld or used in small doses. A urinary examination will also be made after each administration of salvarsan or neosalvarsan. Intense headache after the administration of salvarsan is a danger signal. To counteract this complication, in addition to the usual measures, adrenalin in one-half milligram doses administered subcutaneously has been recommended.

Salvarsan versus Neosalvarsan.—Neosalvarsan weighs one and one-half times as much as salvarsan for the equivalent content of arsenic, and the ratio of dosage is therefore 3 to 2; *e. g.*, 0.9 gm. neosalvarsan is equivalent to 0.6 gm. salvarsan. Salvarsan, however, is clinically more effective in proportionate doses than neosalvarsan and should be used when intensive effect is desired, as in attempting a rapid cure. During the year 1913 over 1000 more doses of neosalvarsan were used than of salvarsan, but, while no restriction has been placed on the choice of these drugs, neosalvarsan should not

be used to the exclusion of salvarsan simply because it is easier to handle.

Method of Preparation.—Salvarsan.—Salvarsan is put up in sealed ampules filled with a neutral gas to prevent oxidation, and only intact ampules should be used. Salvarsan, when dissolved in water or salt solution, forms an acid salt which is too caustic for use; on neutralizing it with sodium hydroxide, the soluble acid salt is changed into a neutral base which is insoluble; further addition of sodium hydroxide converts the insoluble neutral base into an alkaline sodium salt which is soluble; 0.8–0.9 c.c. of a 4 per cent. sodium hydroxide solution is required for each 0.1 gm. of powder—*i. e.*, if the dose is 0.5 gm., 4–4.5 c.c. of the 4 per cent. solution of sodium hydroxide will be required. The end point is the complete solution of the precipitate; care should be taken not to go beyond this point, as an excess of alkalinity is liable to cause a thrombosis. To avoid this a small amount of precipitate may be left undissolved.

The solution of salvarsan, prepared as described above, is added to 60–150 c.c. of an 0.85 per cent. salt solution and administered at room or body temperature. The salt solution should be made with *freshly distilled* water, *sterilized* immediately, and kept well stoppered until used. Salt solution made of stale distilled water contains many dead organisms after sterilization and produces severe reactions.

Neosalvarsan.—Neosalvarsan dissolves readily in water and forms a neutral solution ready for use. It is more unstable than salvarsan and should be given immediately after preparation at *room temperature.* It may be given in about 150 c.c. of a 0.4 per cent. salt solution with the standard apparatus, or in concentrated solution, 0.9 gm. in 20 c.c. of distilled water with a syringe.

Intravenous Injections.—These are easily given with the standard apparatus, which should contain a light plug of absorbent cotton in the neck to filter out undissolved particles,

etc. The injection tube and needle should be filled with salt solution before the prepared solution is poured into the reservoir, so that salt solution only will escape into the tissues if the vein is missed on the first trial. In most cases it is unnecessary to expose a vein by incision, which incision is justifiable only when absolutely necessary.

Intramuscular Injections.—These should be used only when intravenous injections are impracticable. The alkaline solution of salvarsan is diluted to about 20 c.c. with sterilized water, and 10 c.c. are injected into each buttock. Or the powder may be suspended in 2–3 c.c. of sterile liquid petrolatum which is similarly injected. For the latter method the syringe must be absolutely dry and should be lubricated with oil or the piston will bind. Neosalvarsan may be given in the same way, either in solution in 20 c.c. of sterile water or in suspension in sterile liquid petrolatum. The painfulness and uncertainty of absorption of intramuscular injections are objections to this method.

Plan of Treatment.—In suitable early cases radical cure in a short time should be attempted on account of advantages of a successful result. In other cases the chronic intermittent treatment by inunction or injection of mercury should be carried out, using salvarsan when necessary to control symptoms and to reduce a positive Wassermann reaction.

Observation of Cases.—In the absence of symptoms the Wassermann reaction is the only reliable index of the infection; after treatment has been suspended, Wassermann reactions should be made at intervals of one or two months. If they continue negative, at the end of a year a provocative reaction should be made. If possible a luetin reaction and examination of the spinal fluid should also be made before the case is closed. A certain proportion of cases are "Wassermann-fast"—that is, the Wassermann reaction is uninfluenced by treatment; these cases usually have aortic lesions or involvement of the nervous system. In such cases examination of the spinal fluid should especially be made.

The information contained in well-kept syphilitic registers has been found to be of great scientific and practical value, and it is enjoined that every effort be made to follow cases closely and to record important data.

W. C. GORGAS,
Surgeon-General, United States Army.

GONORRHEA.

ETIOLOGY.—Diplococcus Gonorrheæ or Gonococcus.

Method of Transmission.—Gonorrheal ophthalmia may be conveyed by the use of towels soiled with gonorrheal discharges and by other methods of indirect contact. Urethral gonorrhea in adult males is always acquired as the result of sexual intercourse with an infected individual.

PERIOD OF INCUBATION.—The incubation period averages two to five days, but may be as long as two or three weeks.

PROPHYLAXIS AND CONTROL.—There is very definite experimental and clinical evidence indicating that the injection of various silver salts into the urethra following intercourse will prevent the disease. The measures to be taken may be summed up as follows:

1. Continence.
2. Venereal prophylaxis. (See Venereal Prophylaxis.)
3. Venereal inspections to detect concealed cases.
4. Punishment of those who develop gonorrhea without taking the prophylactic. (G. O. 17, W. D., 1912, G. O. 31, W. D., 1912, G. O. 13, W. D., 1913.)
5. Efficient treatment of all cases reporting or detected in order that they may not continue as sources of infection.
6. Methods to avoid contact infection. (For prevention of Gonorrheal Ophthalmia.)

CHANCROID.

ETIOLOGY.—Bacillus of Ducrey.

Method of Transmission.—Always by sexual intercourse with an infected individual, although it must be remembered

that the sores are auto-inoculable, so that when the infection is once acquired, sores may continue to develop.

PERIOD OF INCUBATION.—Generally one to five days. In an experimental inoculation of a macacus monkey, a pustule developed in forty-eight hours and an ulcer developed on the third day having all the characteristics of a soft chancre and containing the bacillus of Ducrey.

PROPHYLAXIS AND CONTROL.—The washing described in the circular outlining the method of venereal prophylaxis, and the use of the calomel ointment will undoubtedly prevent the great majority of these infections. Other methods are the same as for gonorrhea and syphilis.

This is purely a local disease and never gives rise to constitutional symptoms as does syphilis, but it causes a great deal of disability and inefficiency among soldiers, owing to the tendency for the organisms to be taken up by the lymphatics, thus causing the characteristic suppurating inguinal buboes which may incapacitate a man for weeks or months.

The three venereal diseases just outlined cause more admissions to sick report and disability than any other class of diseases.

EPIDEMIC JAUNDICE (WEIL'S DISEASE).

Epidemic jaundice has been rather common among soldiers in the trenches in Europe as well as in other parts of the world.

ETIOLOGY.—Spirocheta icterohemorrhagica. This organism may be found in the blood and also in the urine from cases of the disease. Morphologically it resembles the Spirochetæ of relapsing fever. It is pathogenic for guinea-pigs.

Method of Transmission.—After the thirteenth day of the disease the organism may be found in the urine until at least the thirtieth day. Experiments have indicated that the organism is able to penetrate the unbroken skin, and that it is able to live in the water for some time. Therefore it seems probable that when the water in the trenches becomes con-

taminated with the urine of soldiers who suffer or have suffered with this disease, other soldiers standing in this water may contract the infection.

PROPHYLAXIS.—Should be aimed to prevent contamination of the trenches with infectious urine.

1. Prompt reporting of all cases of the disease. Suspected cases should be sent to the rear and diagnosis be made by stained smears of the blood (Wright's stain may be used) or by injecting the blood into a guinea-pig. The guinea-pig suffers from a similar disease and the spirochetes may be found in its blood and in its liver.

2. Isolation of cases until the urine is free from spirochetes. This isolation need not be complete, but the man should be kept out of the trenches, and should be instructed not to urinate except in a water-closet or where the urine may be disinfected. This precaution should be exercised for at least six weeks from the beginning of the disease.

3. The provision of proper urinals in the trenches, and supervision of the men to see that they use them and do not urinate elsewhere.

4. If possible pump all standing water out of the trenches and keep them dry. (See Sanitation of Trenches.)

YELLOW FEVER.

ETIOLOGY.—A filtrable virus at present unknown, but it may be destroyed by heating to 55° C. for ten minutes.

Method of Transmission.—The disease is transmitted only by the bite of the Stegomyia fasciata (calopus). The blood is infectious only during the first three days of the fever, so that the mosquito must bite during this time to become infected. The organism goes through a cycle of development in the mosquito which lasts from twelve to fourteen days, and thereafter the mosquito may transmit the disease to anyone it bites. Mosquitoes once infected can transmit the disease for the rest of their life which averages about one hundred and fifty days.

INCUBATION PERIOD.—Calculated from experimental mosquito bites it varies from two days and twenty-two hours to seven days and five hours. The average period is from three to six days. The period of development in the mosquito plus the incubation period is from fifteen to eighteen days, which is the time that must elapse after the introduction of a case of yellow fever before the appearance of a secondary case.

QUARANTINE.—Based on the information from experimental bites it would be supposed that the quarantine period would have to be seven days in order to be absolutely safe. The official quarantine regulations, however, call for six days, and so far as known no case has developed after having been detained for this period.

CONTROL.—Sanitary measures are all aimed at the mosquito and may be divided into those aimed to prevent the possibility of mosquitoes becoming infected from existing cases, and general measures aimed at reducing the total number of mosquitoes. Gorgas has pointed out that mosquito extermination is not necessary to eradicate yellow fever. If their numbers are much reduced, the chain of infection is sure to be broken. The disease is much easier than malaria to eradicate, largely owing to the fact that patients are only infective during the first three days instead of for weeks or months as in the case of malaria.

I. *Elimination of Infected Mosquitoes.*

1. Early notification of all cases of the disease.

2. Isolation of cases and suspected cases in doubly screened wards.

3. Similar isolation of contacts for the period of six days.

4. Fumigation of rooms occupied by patients to kill mosquitoes that may have bitten.

5. Obtain history from patient of all places visited and fumigate them.

II. *General Measures.*—Systematic mosquito destruction, including all measures for killing both larvæ and adult

mosquitoes as described under Mosquitoes. It must be remembered, however, that the Stegomyia is a peculiarly domestic mosquito and commonly breeds about houses. All water cisterns must be screened, the gutters of houses cleaned, and all receptacles that can hold water, such as empty tin cans water bottles, etc., must be collected and removed. In fighting any particular mosquito a study of the habits of that species must be most carefully studied.

III. *Education.*—This may be conducted by means of lectures, pamphlets, posters, etc. It is most necessary to secure results to avoid antagonizing the native population who are the source of the infection but who must be handled with the greatest tact. A good method described by Gorgas is a system of fines for sanitary lapses, which, however, are remitted providing the nuisance is abated.

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